Chemical Age

£2,000 m. Chemicals Output Foreseen in 1970

(page 603)

VOL. 82 No. 2126

9 April 1960

THE WEEKLY NEWSPAPER OF THE CHEMICAL INDUSTRY

For the transport of corrosive and sensitive liquids—

VALETHENE CONTAINERS

Valethene containers combine the high chemical resistance and inert properties of polyethylene with the strength, robustness and handling characteristics of universally accepted standard steel drums. Bulk transit of corrosive and sensitive liquids can now be made more conveniently, safely and economically.

The semi-rigid moulded polyethylene inner container also protects your materials from contamination and is manufactured by a new patented process. These containers are already widely used in the United States.

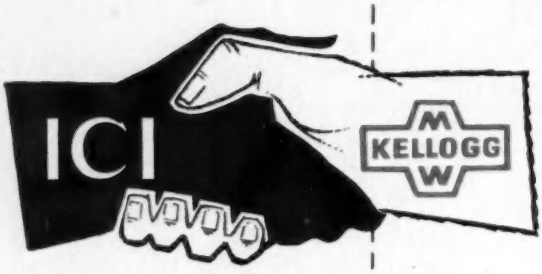
Manufactured entirely and solely by:

METAL CONTAINERS LTD.

METAL CONTAINERS LIMITED, 17 WATERLOO PLACE, PALL MALL, LONDON

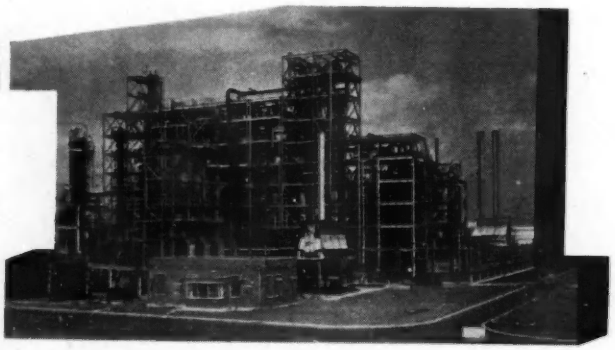
WORKS: ELLESMERE PORT, RENFREW & CRAYFORD ASSOCIATED COMPANIES IN GT. BRITAIN & ABROAD

M-W. 129



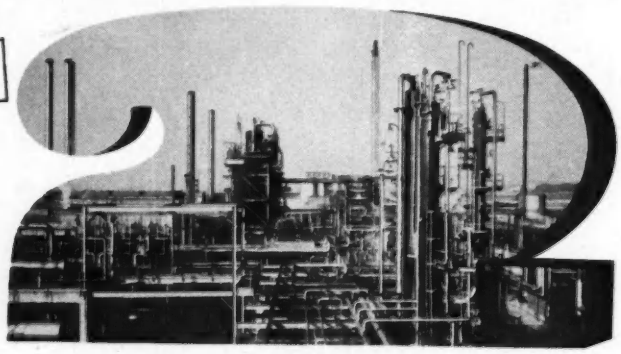
KELLOGG BUILDS FOR ICI EXPANSION

1951



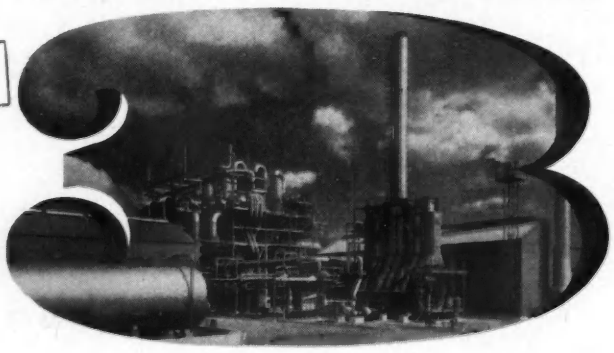
The recent completion of the third olefine plant at Wilton has made these works the largest petroleum chemical venture outside the United States. With a current output of 110,000 tons per year of high-purity ethylene, and a potential output of 140,000 tons, ICI Wilton is a magnificent example of engineering co-operation.

1956



The first plant was commissioned in 1951, and was the first full-scale adoption of the then novel process of oil pyrolosis developed in the Kellogg Laboratories. Its success led to the addition of No. 2 plant in 1956, and then to this latest extension, representing a 60% increase in olefine capacity, in 1959.

1959



Co-operation between client and contractor is the keynote of K.I.C.'s contribution to chemical engineering. The Wilton Olefine Plant is the largest in the world based on liquid feedstock: K.I.C. is proud to have been associated with its development.

KELLOGG

Kellogg International Corporation

KELLOGG HOUSE · 7-10 CHANDOS STREET · CAVENDISH SQUARE · LONDON W.1

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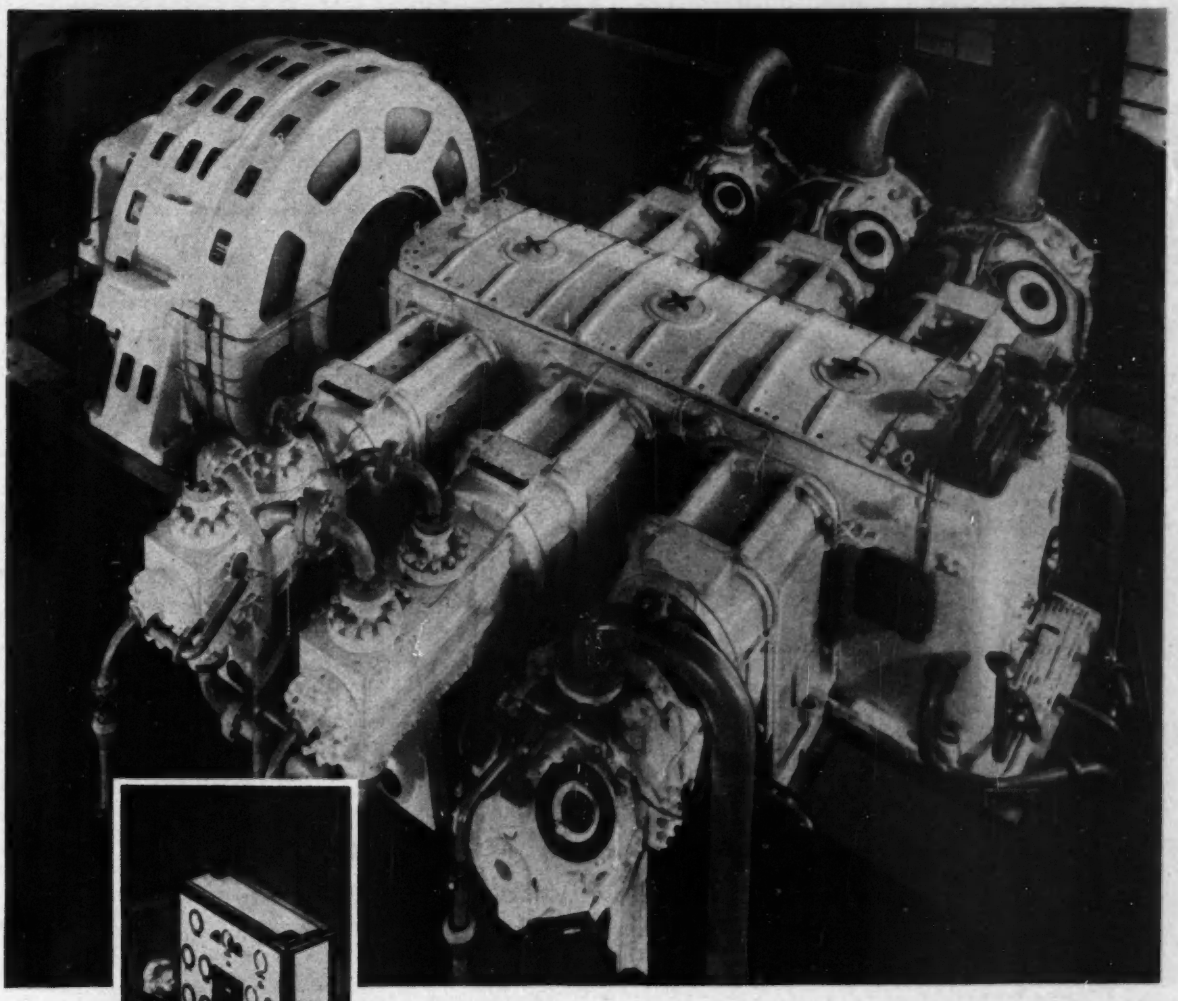

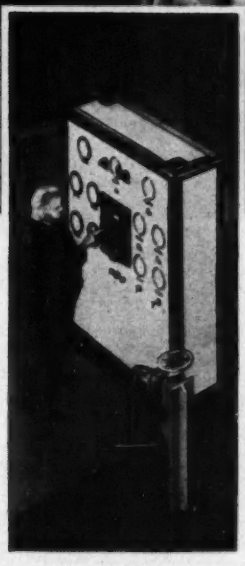

COMPRESSORS FOR INDUSTRY

One of a number of Brotherhood six crank five stage compressors supplied to The British Oxygen Company Ltd. Each compressor has a capacity of 8,670 m³/hour, delivery pressure 185 atmospheres, driven by 3,050 H.P. synchronous motor.

Brotherhood compressors are designed to customers' exact requirements.

PETER BROTHERHOOD LTD.

PETERBOROUGH ENGLAND

Compressor and power plant specialists for nearly a century

P.3629

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CONSULT

FREDERICK ALLEN & SONS (POPLAR) LTD.

PHOENIX CHEMICAL WORKS, UPPER NORTH STREET, LONDON, E.14.

Telephone: EAST 2673 (5 lines) *Cables: NITRIC, POP, LONDON*

STOCKDALE ENGINEERING LIMITED

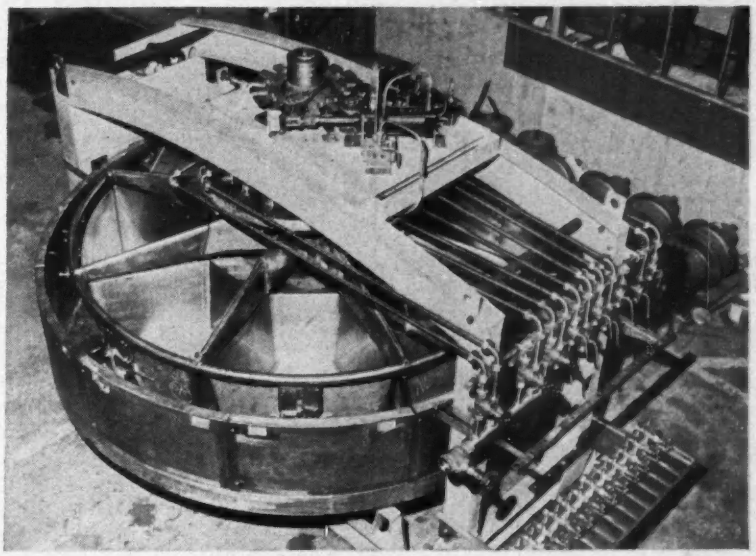
CHEMICAL ENGINEERING news

POYNTON CHESHIRE NO. 13

STOCKDALE DEVELOP DEEP-BED TIPPING-PAN FILTER

The new tipping-pan filter is designed for multi-stage counter-current washing for application in critical extraction processes. Deep pans, solids-discharge by 180° turnover and maximum utilisation of available filter area are incorporated. Control of bed depth over a wide range considerably extends the applications of this type of filter.

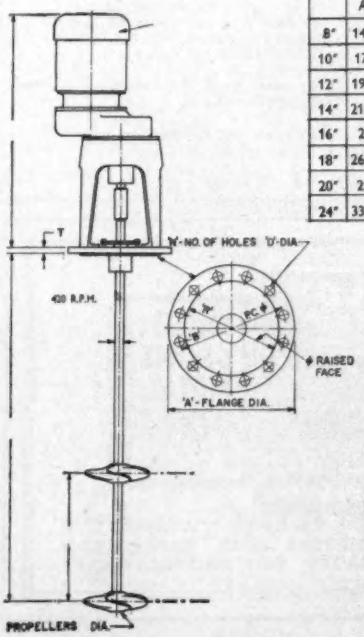
This filter represents the solution of yet another filtration problem. Whether the problem requires a special solution or whether it can readily be solved by selection from the wide range of standard units, Stockdale's Filtration Division will give each project the advantages of sound engineering, imaginative thinking and precise process investigation.



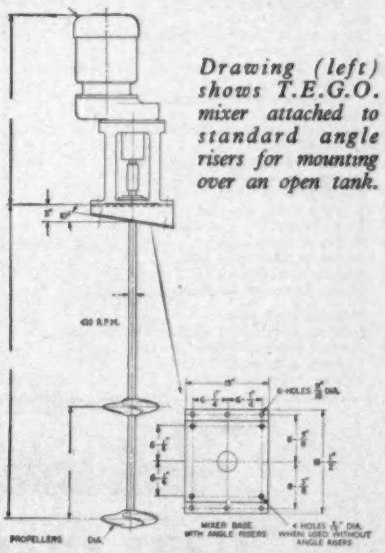
INITIAL SERVICE ENSURES SUCCESSFUL APPLICATION

U. K. Mixer Range—T.E.G. Drives. For mixer applications requiring ¼ to 3 h.p., standard units have been designed to produce over 150 combinations. On receipt of enquiry, potential users receive Data Sheet for completion and subsequent quotation is accompanied by comprehensive engineer's drawing similar to those illustrated here. *Omitted dimensions indicate that these measurements can be adjusted to suit user's requirements.*

NOM'N SIZE	B.S. FLANGE TABLE. F. A.S.A. FLANGE SERIES. 150. STANDARD STOCK FLANGE									
	A.	B.	N.	D.	T.	A.	B.	N.	D.	T.	R.
8"	14½"	12¾"	12	¾"	1"	13½"	11¾"	8	⅞"	1 1/16"	10⅛"
10"	17"	15"	12	1"	1"	16"	14¼"	12	1"	1⅛"	12⅛"
12"	19¼"	17¼"	16	1"	1⅛"	19"	17"	12	1"	1 3/16"	15"
14"	21¾"	19¼"	16	1⅛"	1¼"	21"	18¾"	12	1⅛"	1 5/16"	16¼"
16"	24"	21¾"	20	1⅛"	1¼"	23½"	21¼"	16	1⅛"	1⅜"	18½"
18"	26½"	24"	20	1¼"	1⅜"	25"	22¾"	16	1¼"	1½"	21"
20"	29"	26¼"	24	1¼"	1½"	27½"	25"	20	1¼"	1⅝"	23"
24"	33½"	30¾"	24	1⅜"	1⅝"	32"	29½"	20	1⅜"	1 13/16"	27½"



Drawing (left) shows T.E.G.S. unit fitted with split gland stuffing box. Mechanical seal can be provided if required. Standard flange sizes are detailed in table (above).



Drawing (left) shows T.E.G.O. mixer attached to standard angle risers for mounting over an open tank.

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- **Filters** ... ...
- **Pilot Plant Service** ... ...
- **Mixers** ... ...
- **Process vessels** ... ...
- **Pipework** ... ...
- **Valves** ... ...
- **Rubber and lead lining** ... ...
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Please tick as required

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POYNTON, CHESHIRE. *Tel. Poynton 2601.*

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2-Amino-5-diethylaminopentane
Azelaic acid derivatives
Arachyl alcohol
Behenyl alcohol
1-Bromo-3-propanol
Butene-2-diol-1:4
Chalcone and Derivatives
6-Chloro-hexanol-1
Choline compounds
Colchicine
Colchicoside
Cyclodecanol
*Cyclodecanone
Cyclodecane
Cyclodecyl halides
Cyclodecylamine
Cyclodecyl urea
Cyclododecanol
Cyclododecanone
Cyclododecane
Cyclododecyl bromide & chloride
Cyclododecylamine
Cyclododecyl urea
*Cycloheptyl urea
Cyclohexyl urea
Cycloheptane
Cycloheptanol
Cycloheptanone
Cycloheptyl bromide & chloride
Cycloheptylamine
*Cyclononane
Cyclononanol
*Cyclononanone
Cyclononyl halides
Cyclononylamine
Cyclononyl urea
Cyclooctane
Cyclooctanol
Cyclooctanone
Cyclooctyl halogenides
Cyclooctylamine
Cyclooctyl urea
Cyclopentanol
Cyclopentanone
Cyclopentylamine
Cyclopentyl bromide & chloride
Cyclopentyl urea
*Cycloundecane
*Cycloundecanol
*Cycloundecanone
Decahydroquinoline (cis & trans)
Decamethylene dinitrile
Decanediol-1:10
1, 5-Diaminopentane
1, 7-Diaminoheptane
1, 8-Diaminooctane
1, 9-Diaminononane
1, 10-Diaminodecane
1, 11-Diaminoundecane
1, 12-Diaminododecane
1, 13-Diaminotridecane
1, 5-Dibromopentane
1, 6-Dibromohexane
*1, 7-Dibromoheptane
1, 8-Dibromooctane
1, 9-Dibromononane
1, 10-Dibromodecane
1, 11-Dibromoundecane
1, 4-Dibromobutene-2
*1, 7 (2:8) Dibromooctane
2, 5-Dibromo-hexene-3
2, 5-Dibromohexane
1, 6-Dichlorohexane
*1, 7-Dichloroheptane
1, 8-Dichlorooctane
1, 9-Dichlorononane
1, 10-Dichlorodecane
1, 4-Dichlorobutene-2
2, 5-Dichloro-hexane-3
2, 5-Dichlorohexane
2, 3-Dichloro-1, 4-naphthoquinone
Dicycloheptylamine
1, 4-Dicyclohexanolyl diacetylene
Dicyclooctylamine
Dicyclopentadienyliron
Dicyclopentylamine
Dicyclohexanolylbutane

*Dihydromucodinitrile
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1, 8-Diiodooctane
1, 8-Dimethoxyoctane
1, 8-Dimethoxyoctadien-1, 7-diyne-3, 5
Dimethyl brassylate
2, 5-Dimethyltetrahydrofuran
Dimethyl thapsate
*N'N-Dimethylaminoglycerol
*2, 5-Dimethylpyrroline
Dimethyl dodecamethylene dicarboxylate
3, 8-Dimethyloctanediol-2, 7
2, 7-Dimethyloctadiyne-3, 5-diol-2, 7
3, 8-Dimethyldecanediol-3, 8
3, 8-Dimethyldecadiyne-4, 6-diol-3, 8
2, 5-Dimethyl pyrrole
1, 6-Dimorpholinyl-hexadiyne-2, 4
Di-n-decylamine
Dodecandioic acid dimethylate
ethyl acetamidocyanoacetate
bis gamma Phenylpropylethylamine base
*Heptanediol-1, 7
Heptamethylene dinitrile
n-Heptadecyl alcohol
n-Heptadecanoic acid nitrile
Heneicosylic acid
Heptadecylic acid
Hexanediol-1, 6
Heneicosylic alcohol
Hexanediol-2, 5
n-Heneicosanoic acid nitrile
Hexadecanediol-1, 16
Hexamethylene dinitrile
Hexahydro-p-xylyldiamine
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beta-Hydroxyethylmorpholine
Hexene-3-diol-2, 5
Ibogain
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1-Methoxybuten-1-in-3
5-Methoxy-3-chloropentene-1
methylaminoacetocatechol HCl:
3-Methylheptanediol-2, 4
3-Methyl-5-ethylheptanediol-2, 4
3-Methylpentanediol-2, 4
3-Methyl-5-ethylnonanediol-2, 4
2-Methyltetrahydrofuran
1-Methyl-1, 2, 3, 4-tetrahydroquinoline
4-Methyltetrahydropyran
2-Methyl-1, 2, 3, 4-tetrahydroisoquinoline
n-Nonadecylic alcohol
Nonadecylic acid
Nonamethylene dinitrile
n-Nonadecanoic acid nitrile
Nonanediol-1, 9
Octamethylene dinitrile
*Octanediol-1, 8
n-Pentadecyl alcohol
Pentadecylic acid
Pentadecandioic acid dimethylate
Pentamethylene dinitrile
n-Pentadecanoic acid nitrile
*Pentadecanediol-1, 15
*Pimelic acid
Pivalic acid
*Pyrroline
trans-Stilbene
Suberic acid
Serotonin creatinine sulphate
Tetradecandioic acid dimethylate
1, 2, 3, 4-Tetrahydroisoquinoline
1, 2, 3, 4-Tetrahydroquinoline
Tetrahydropyran
*Tetradecanediol-1, 14
Tridecylic acid
*Thapsic acid
*Tridecylic alcohol
n-Tridecanoic acid nitrile
Triacosylic acid
n-Triacosylic alcohol
n-Triacosanoic acid nitrile
Tridecandioic acid dimethylate
Tri-n-octylamine
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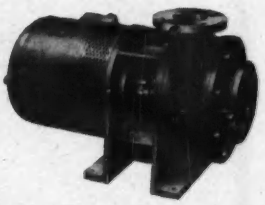

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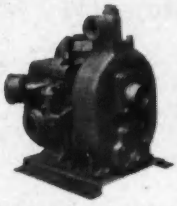

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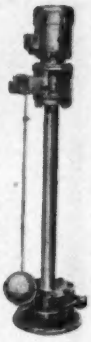

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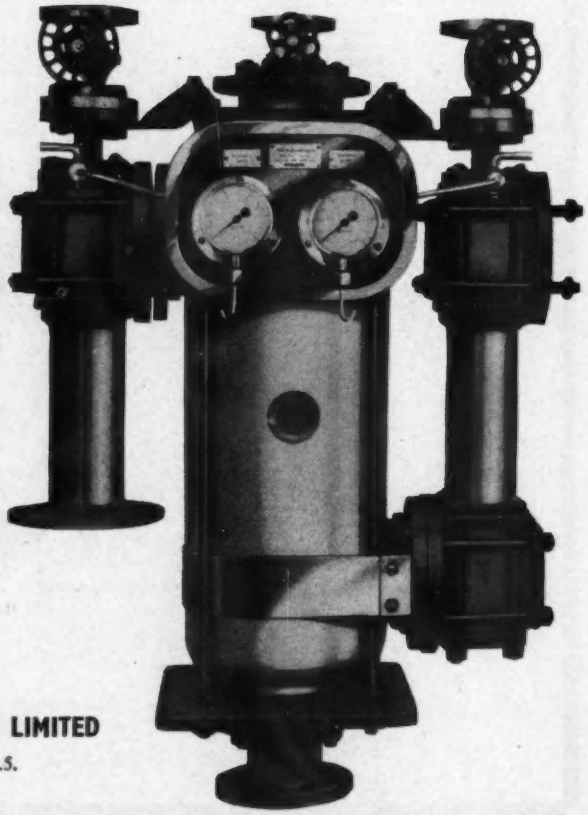

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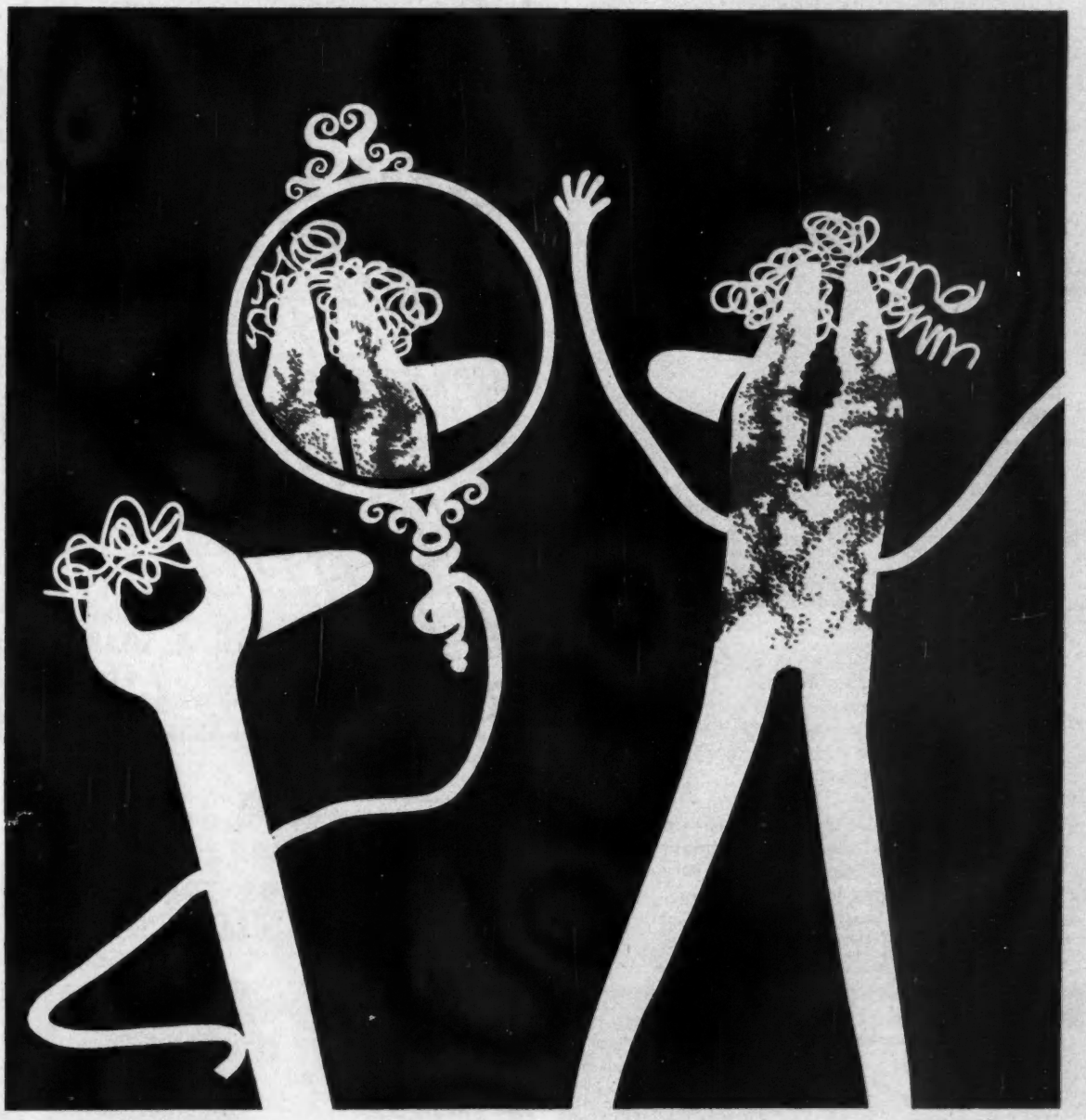

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for alkaline de-rusting

Sequestrol CS Liquid has been specially developed for the formulation of alkaline de-rusting solutions, particularly for precision equipment in which attack upon or embrittlement of the steel must be kept at an absolute minimum. It is best used electrolytically and solutions so used can be automatically regenerated, losses being due to dragout only. Sequestrol CS Liquid can also be used to solubilise, or prevent the formation of, iron sludge in strongly alkaline solutions such as etchants for aluminium.

Recommendations on request from Development Division

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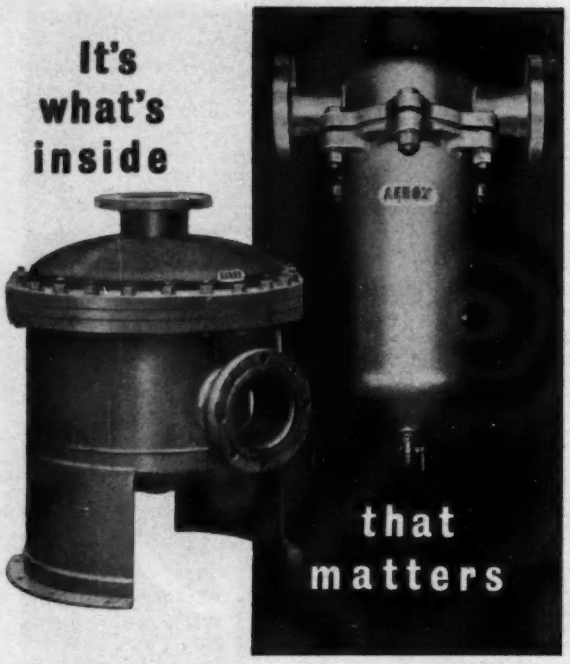
E37

Geigy

B



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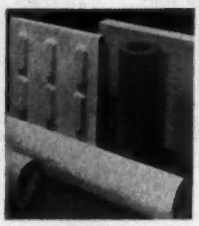

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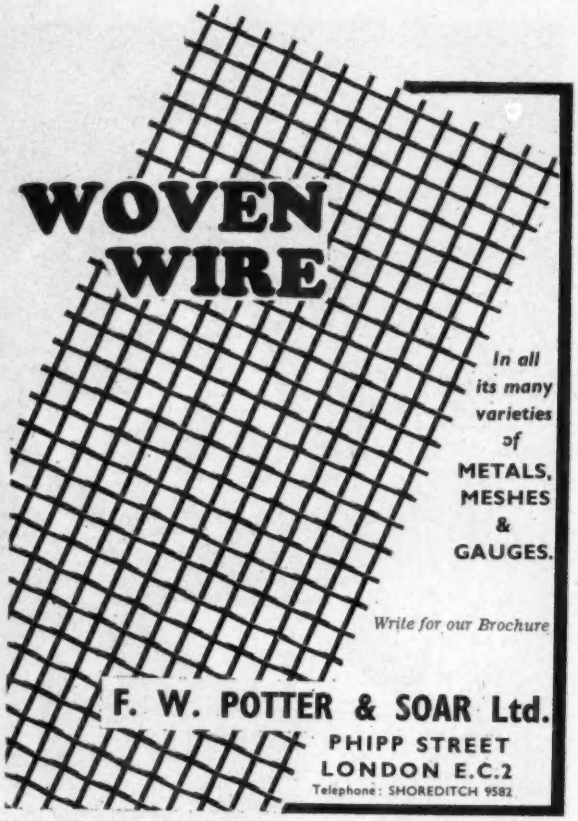

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300	16 oz. in.	25	4 lb. in.
150	24 oz. in.	18.8	4 lb. in.
100	32 oz. in.	12.5	4 lb. in.
75	36 oz. in.	9.4	4 lb. in.
50	3 lb. in.	6.25	4 lb. in.

SHADED-POLE INDUCTION GEARED MOTOR—Type 'FA'

R.P.M.	TORQUE	R.P.M.	TORQUE
216	4 oz. in.	13.5	24 oz. in.
108	7 oz. in.	9	30 oz. in.
54	10 oz. in.	6.7	35 oz. in.
36	12 oz. in.	4.5	44 oz. in.
27	15 oz. in.	3.35	3 lb. in.
18	20 oz. in.	2.25	4 lb. in.

VARIABLE SPEED GEARED MOTOR—Type 'KQ'

R.P.M.	TORQUE	R.P.M.	TORQUE
200-600	9 oz. in.	12-37.5	4 lb. in.
100-300	16 oz. in.	8-22	4 lb. in.
50-150	20 oz. in.	6-16.5	4 lb. in.
32-100	32 oz. in.	4-11	4 lb. in.
25- 75	40 oz. in.	3- 8.25	4 lb. in.
16- 50	48 oz. in.	2- 5.5	4 lb. in.

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R.P.M.	TORQUE	R.P.M.	TORQUE
456	8 oz. in.	28.5	3 lb. in.
228	13 oz. in.	19	4 lb. in.
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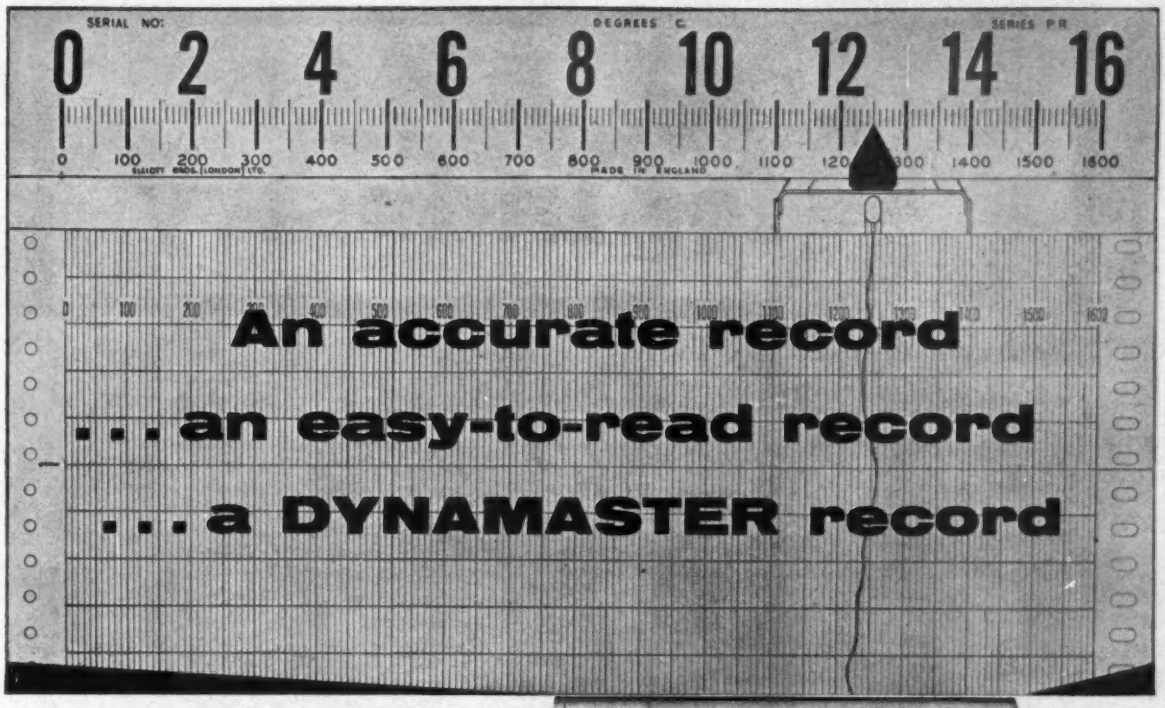
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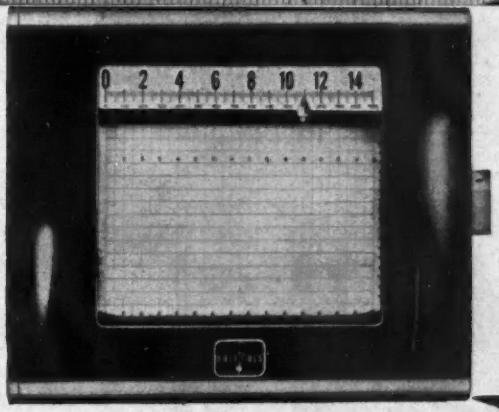

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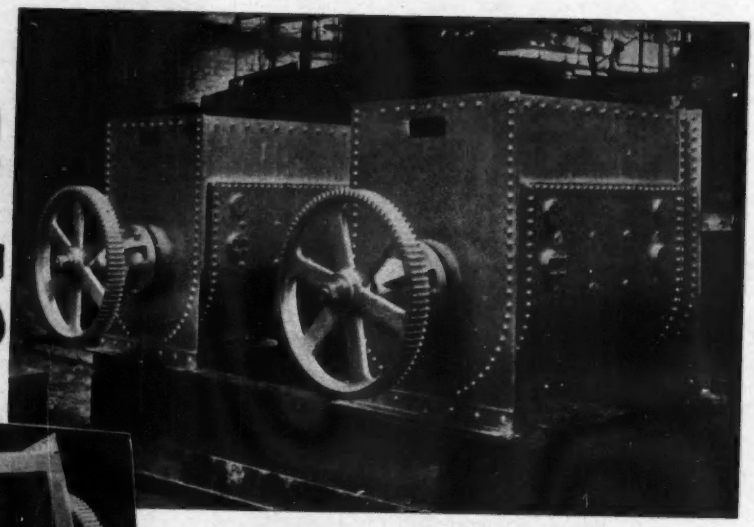

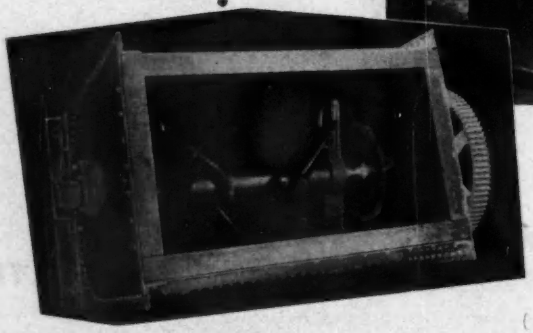

These hot water jacketed Mixing Vessels (capacity ½ Ton each) are for use in chocolate manufacture. The lower photograph shows the stirring gear. We manufacture Mixers, Blenders and Process Vessels for a wide range of Industries and applications.

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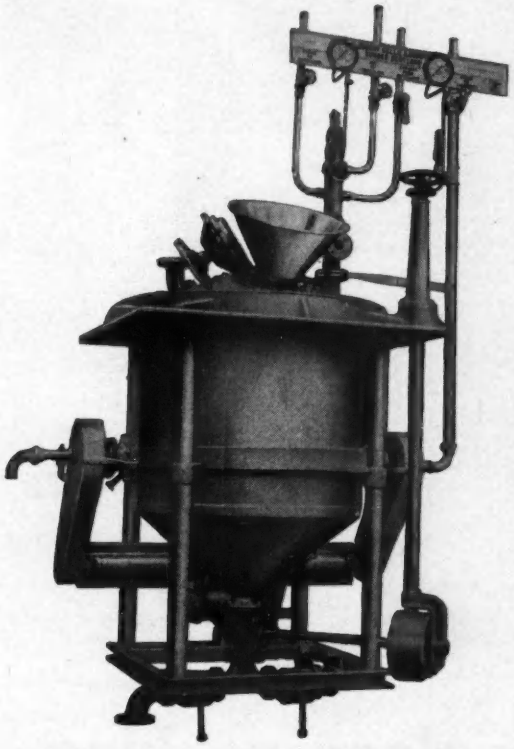

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No steam jacket is employed, and there is no local overheating.

Processing is by patent steam-heated Revolving Calandria, which incorporates a Swash Plate Impeller.

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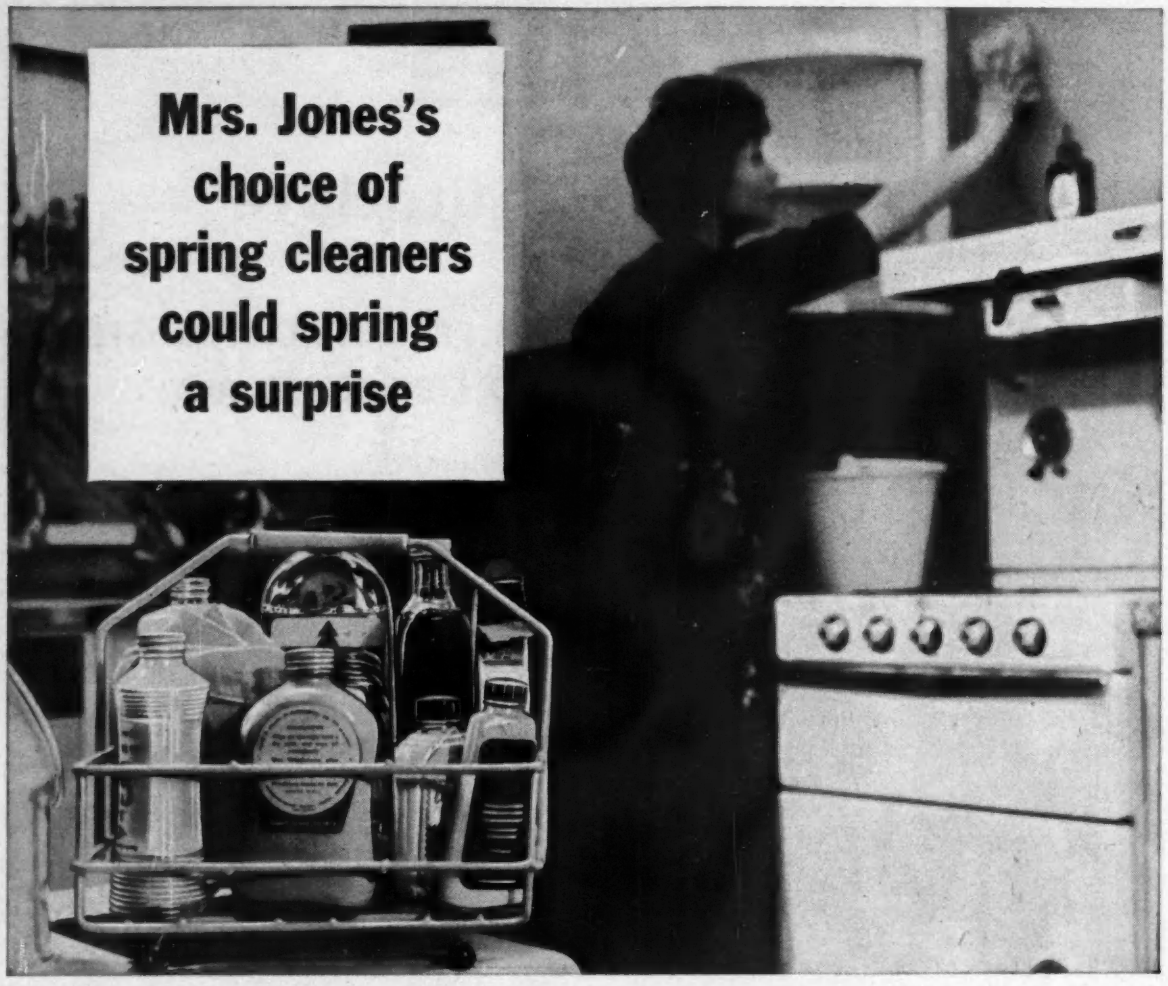
C



INDEPENDENT RESEARCH SHOWS

Most women prefer glass packing

A new survey of consumers' packing preferences shows clearly that, given the opportunity, the vast majority of housewives would prefer to buy glass packed goods.

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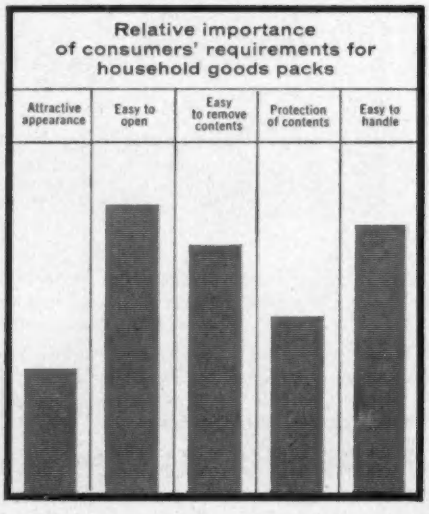

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MALEIC ANHYDRIDE

BY the end of this year the maleic anhydride shortage which now exists in the U.K. will be completely overcome. One new plant, that of Alchemy Ltd., is scheduled to be in operation by the third quarter of the year. (CHEMICAL AGE, 29 August 1959, p. 215.) No details regarding capacity, however, have been announced. In October 1958, Monsanto Chemicals Ltd., the major U.K. suppliers of maleic anhydride, announced that they were to build a further plant to produce 15 million lb. of maleic anhydride a year, which would treble the company's production of this chemical. This plant is expected to be on-stream towards the end of this year and Monsanto say that it will meet all foreseeable future requirements of the British chemical and allied industries and will allow a surplus for export.

Maleic anhydride has uses in many branches of the chemical industry for it is a highly reactive compound and contributes, with its many derivatives, to manufactures ranging from oil additives to pharmaceuticals. Its chief value lies, nevertheless, in the readiness with which it forms resins and takes part in organic reactions. Thus part of the phthalic anhydride in alkyd resin formulations may be replaced by maleic anhydride, which reacts more rapidly and so shortens the processing time. A maximum of 15% of the phthalic anhydride may be replaced, 2 to 5% being the usual proportion. In the modified drying and semi-drying oils, 3 to 7% by weight of maleic anhydride is stated to reduce the air drying time of a semi-drying oil to about five hours.

Rosin (or abietic acid) treated with maleic anhydride results in a Diels-Alder adduct which on esterification with a polyhydric alcohol yields modified ester gums with increased hardness, high melting point and rapid solvent release, while having improved colour retention. Thermosetting resins are formed when maleic anhydride is condensed with a terpene and esterified with a polyhydric alcohol; a number of resin products are produced by reacting maleic anhydride and tall oil and esterifying, usually with pentaerythritol; and copolymerisation of maleic anhydride esters with a vinyl material such as styrene monomer yields strong resins suitable for low pressure lamination.

The above outlets for maleic anhydride are now well known and, in fact, it is the boom in polyester resins over the last two years that is responsible for the present maleic anhydride shortage. In this country, too, a sizeable proportion of anhydride is taken up in paper-sizing resins so that this is at present the second most important demand. This contrasts with the present state of affairs in the U.S., where the second major outlet for this anhydride is in alkyd-coating resins and in the fungicide field such as for production of malathion (15% of total maleic anhydride demand) and maleic hydrazide. In the U.K., it is difficult to determine the position regarding alkyds, although it is suggested that 5% of maleic anhydride production goes into alkyds manufacture.

Expected to be showing an increasing trend in the U.K. is the use of maleic anhydride in agricultural chemicals (20 to 30% in malathion production at present) and some consider it will take second place to polyester

resin demand. At present this outlet for maleic anhydride is being held down by the shortage of anhydride, but maleic hydrazide, the cyclic product of maleic anhydride and hydrazine, for instance, has a number of agricultural uses as a growth regulant and selective herbicide, which can be expected to expand. Also the anhydride reacts with butadiene to form an intermediate from which the fungicide N-trichloro methyl thio tetrahydrophthalimide can be produced, and an organic thionophosphate, S-(1,2-dicarbethoxyethyl) O,O-dimethyl dithio-phosphate used as an insecticide is obtained by a synthesis involving maleic anhydride.

Third place in the major outlets for maleic anhydride is likely to be taken by its use in melting agents, i.e., the anhydride is readily reduced to succinic anhydride by catalytic hydrogenation and succinic anhydride can be used in a variety of formulations, including water repellents, plasticisers, germicides, lubricants, pharmaceuticals, etc. Wetting agents, emulsifying agents and detergents for the textile industry are manufactured with monoalkyl esters of maleic anhydride by reaction with sodium sulphite or sodium bisulphite solutions and foaming and wetting agents can be produced by sulphonating esterified copolymers of polymerised terpenes and maleic anhydride.

Next in importance, it is suggested, will be the use of maleic anhydride in production of fumaric acid and fumarates (by heating the anhydride with water under pressure in the presence of a catalyst).

Of the other outlets for maleic anhydride, which take small and varying amounts of the compound, the maleic esters are thought likely to grow in importance since these can be used as internal plasticisers in vinyl copolymer resins, e.g. derivatives such as diethyl maleate and dibutyl maleate.

With these various applications for maleic anhydride and their potentialities it is small wonder that there is a growing shortage of this material. The new plants now under construction suggest, however, that within a short time there might be overcapacity problems, if only of a temporary nature.

The main company for designing and setting up maleic anhydride plants is Scientific Design Co. Inc., New York. At present there are 10 S.D. maleic anhydride plants either in operation, under construction or projected, which will have a total production capacity of 130 million lb., which is stated to be more than half the world's capacity. On stream now is American Cyanamid's Bridgemille, Pennsylvania plant and Heyden Newport have a new plant under construction at Fords, N.J. (see C.A., 8 August 1959, p. 107). Other S.D. maleic anhydride projects in the U.S. are for Pittsburgh Coke and Chemical Co., Neville Island, Pennsylvania, Monsanto Chemical Co., St. Louis, Missouri, Reichhold Chemicals Inc. and Elizabeth, New Jersey. In Canada, S.D. will build for Monsanto Canada Ltd. a maleic anhydride plant at Ville la Salle, Montreal.

In the U.K., Monsanto Chemicals new plant at Newport is an S.D. plant and in Europe the company have designed that of Compagnie Francaise de Matieres Colorantes at Villiers-St. Paul, France, and will be responsible for that of Ftalital S.p.A., Scanzorosciate, Italy.

Elsewhere in Europe the Rühröl concern in West Germany, Mathias Stinnes AG., are extending their maleic anhydride capacity to 3,000 tonnes a year and in Spain, Resinas Poliesteres SA. Umgnesa and U.E.E. with Saint-Gobain of France have received permission for a 1,500 kg./day capacity plant.

INTEREST IN METHANOL

IN the last few weeks, new methanol facilities have been announced by Imperial Chemical Industries Ltd. (CHEMICAL AGE, 19 March, p. 489) and British Hydrocarbon Chemicals Ltd. (CHEMICAL AGE, 26 March, p. 529). The I.C.I. methanol extension which is already on stream will raise capacity by 30,000 tons a year but the capacity of the new B.H.C. plant due on stream in 1961 is not given.

B.H.C. indicated that the methanol would be sold for economic reasons—most probably for production of formaldehyde (oxymethylene)—the major outlet for methanol. I.C.I., it appears, intend to use their methanol production for their own purposes. It is therefore interesting to speculate what these purposes might be and hence the significance of these expansions especially as I.C.I.'s methanol will be of high purity.

In the U.S., E. I. Du Pont De Nemours and Co. have, as Dr. W. H. Linton indicated at the Polymeric Progress Conference in London (see C.A., 2 April, p. 567), carried out a great deal of fundamental research on formaldehyde polymerisation and this has lead to the commercialisation of Delrin acetal resin. At Parkersburg, West Virginia, Du Pont have a new $40 million Delrin plant with an initial capacity of 12 million lb./year. This plant is understood to be in full production, offering both moulding and extrusion grades and a choice of 14 colours. From a development price of 95 cents/lb., the price has come down to 88 cents/lb. and with the present low cost of formaldehyde the price is expected to come down still more.

Other U.S. companies, noting the interesting properties of this highly crystalline thermoplastic-high tensile strength, high resistance to corrosion, ease of fabrication, infinite fatigue life, and low moisture absorption—have also been making plans to produce this resin. In particular, Reichhold Chemicals, major producers of formaldehyde and other resins, are definitely interested in polyoxymethylene and have already carried out a certain amount of work on polyformaldehyde. Price, however, seems to be a stumbling block.

Among the other U.S. companies which produce formaldehyde are Monsanto, Celanese, Commercial Solvents, Hayden Newport and Allied Chemical, but so far none of these have expressed any interest or announced any development work on polyoxymethylenes.

In this country it is known that I.C.I. were actively engaged in research on polyoxymethylene resins some few years ago, and the news of the methanol extensions suggests that their development work may have reached the stage for commercialisation. Another company that has announced extensions in formaldehyde is B.I.P. Chemicals Ltd. (see CHEMICAL AGE, 16 January 1960, p. 135). The West German companies Badische Anilin and Soda Fabrik, Farbwerke Hoechst and Farbenfabriken Bayer have also been investigating the polyoxymethylenes. B.A.S.F. are expected to make an announcement shortly while Bayer and Hoechst are reported to have reached advanced stages in development. Recently, too, B.A.S.F. patented a process for production of high purity formaldehyde—the key to successful production of polyformaldehyde.

Other companies in Europe known to be interested in formaldehyde polymers are the Netherlands Staatsmijen (Limburg) who are said to have a similar product to Delrin, and St. Gobain in France. Further East, some Japanese companies have been investigating formaldehyde resins.

All things considered, it looks very much as if formaldehyde polymers will be in the news in a big way soon. The only problem at present seems to be that of price.

Project News

Contracts Awarded for New B.H.C. Projects

● BRITISH subsidiaries of U.S.-based contracting companies have been awarded the contracts for the construction of the three new petrochemical plants to be built at Grangemouth for British Hydrocarbon Chemicals Ltd. (see 'Project News', 26 March, p. 529).

Chemical Construction (G.B.) Ltd., 9 Henrietta Place, London W.1, have been awarded the contract for the methanol plant; the Lummus Co. Ltd., 80 Regent Street, London W.1, contract for the ethylene dichloride plant; and Fluor Engineering and Construction Co. Ltd., Finwell House, Finsbury Square, London E.C.4, contract for the butadiene plant.

Chemico state that the synthetic methanol plant, which they will design, engineer and construct, will use hydrocarbon gases from the B.H.C. ethylene plants as feedstock. These gases will be reformed to carbon dioxide, carbon monoxide and hydrogen, in ratios suitable for the high pressure synthesis of methanol.

The crude methanol will be refined by extractive distillation to produce a high purity material suitable for use in the production of resins, anti-freeze and various esters, solvents, etc. The B.H.C. methanol plant will be the sixth that Chemico have designed.

● WORK was started last week by Holland and Hannen and Cubitts (Great Britain) Ltd., on a £58,000 extension to the soap and detergents process building of Thomas Hedley and Co. Ltd. at West Thurrock, near Grays, Essex. The extension will be completed by the end of the year.

● SHELL and B.P. are to build a refinery in Northern Ireland. Shell experts have completed their study of the Ulster coast line, and a decision on the actual site is expected soon. It is understood that the most favoured site is near Kilkeel. Producion is expected to start about two years after selection of a site.

● SEVERAL new refinery projects and extension plans are planned. Procon are stated to have been awarded a contract for a refinery in France, while Shell are planning a refinery in Assam. An extension to the Caltex refinery in Australia is planned, while contracts for refineries in Algiers and Lisbon are reportedly held in abeyance due to financial reasons. A refinery is also planned in Finland and B.P. are said to have plans for a new refinery in Dublin.

Q.V.F. Receives Visit from South Korea

A recent visit of Mr. Kim Joong Bae to the Q.V.F. Ltd. Stoke-on-Trent factory resulted in inquiries to the value of some £150,000. Mr. Kim is one of South Korea's leading industrialists, and the visit is regarded by the company as indicative of growing Korean interest in a wider range of glass chemical plant.

D.C.L. Licence New Ammoxidation Process to Ugilor of France

AN acrylonitrile plant, based on the ammoxidation process developed by the Distillers Company Ltd. is to be built by Ugilor of France. In the process, propylene is reacted with ammonia and oxygen using a catalyst. D.C.L. are reported to have been studying ammoxidation for several years, while Standard Oil, Ohio, are building an acrylonitrile plant in the U.S. based on ammoxidation of propylene.

Work of the Distillers Company in this field was outlined recently by Mr. D. J. Hadley, of the company's research laboratory at Epsom, Surrey, at a meeting of the Society of Chemical Industry. Research in this field was begun in two stages, converting acrolein to acrylonitrile and oxidising propylene to acrolein —later the work was handled as one programme.

Molybdic oxides supported on alumina are among materials which catalyse the reaction of acrolein with ammonia and oxygen. Part of the D.C.L. work has been to examine reaction rates to develop kinetics of the process. It was found that acrolein reacted speedily with ammonia:

$$CH_2 = CHCHO + NH_3 \longrightarrow CH_2 = CHCH = NH + H_2O$$

but the reaction with oxygen which followed was relatively slow:

$$CH_2 = CHCH = NH + \tfrac{1}{2}O_2 \longrightarrow CH_2 = CHCN\ H_2O$$

The main by-products are carbon dioxide and hydrogen cyanide. With a mature catalyst, acrolein yields run as high as 90%.

It is stated that early attempts to combine these reactions to convert propylene directly to acrylonitrile—using the same catalyst that had been used for the acrolein ammoxidation—gave yields of acrylonitrile of only 50%, with the side reactions producing mostly acetonitrile. A better catalyst was developed, resulting in higher yields. Standard Oil, Ohio, instance one example of an improved catalyst in patent literature—the addition of bismuth oxide to catalysts used earlier which improved the process (*Chem. Engn. News*, 1960, **38**, No. 14, 59.

According to D.C.L. the product can be worked up by distillation. But in separating small amounts of acrolein and hydrogen cyanide from acrylonitrile, the two by-products tend to combine to form acrolein cyanohydrin; this can be controlled, however.

It is felt that this process using propylene would be more economical for acrylonitrile than acetylene or ethylene oxide, which are more expensive and are not as easy to process.

Also under study at Epsom is the ammoxidation of xylenes and it is felt that this approach is an improvement on the normal method of oxidising xylenes to acids. It converts xylenes to nitriles, which can then be converted into amines, esters or amino acids. Terephthalic esters, for instance, can be made from *p*-xylene through ammoxidation. Phthalonitrile can be made by ammoxidising *o*-xylene and could be used in phthalocyanine pigments. D.C.L. workers find that β and γ-picolines undergo ammoxidation to give cyanopyridines. γ-Cyanopyridine can be partially hydrolysed to the amide, which reacts with hydrazine to give isoniazid. β Cyanopyridine can be converted into nicotinamide.

Polyester Resin Glass Fibre Sheet

CONTINUOUS lengths of translucent polyester resin fibre glass corrugated sheeting are now available in this country. The material has become widely used for roof-lights as it is light, shatterproof and does not require expensive glazing bars, but up to the present it has been available in Britain only in the form of panels. A company, C.L.D. Ltd., has been formed to manufacture under licence in this country, by a process patented by Montecatini of Italy. Sales arrangements will be controlled by Joseph Weil and Son Ltd., 39-41 New Broad Street, London E.C.2.

The new process produces a translucent sheeting with a width of 6½ feet (parallel to the corrugations) and a length of 30 yards or more as required. The material, which is formed into a roll, will be marketed under the trade-name of Contirol and will also be available in a wide range of light fast and weatherproof colours, both translucent and opaque. Although the factory in this country will not be operating until the autumn, limited supplies are now being imported from the Continent. These are identical with the eventual home production and are being used to introduce the material to the market.

Contirol will have many uses in industry, agriculture and the home due to its decorative effect, ease of application and adaptability. Some applications taken from established usages on the Continent are as fences, internal partitions, machinery screens, canopies for loading bays, verandahs, greenhouses, implement sheds, park shelters, roofs for car parks, filling stations and bicycle sheds, windbreaks and exhibition stands.

It is interesting to note that, being applied in long lengths, it can be removed from temporary buildings and shelters, rolled up, stored and used again at a later date. Also, being shatterproof and extremely durable it has a very long life and this, coupled with the fact that it needs no maintenance, makes it an economic proposition for many purposes.

Supplies are available from distributors throughout the country and literature can be obtained from Joseph Weil and Son Ltd.

★ BIG disappointment of the Budget so far as industry is concerned was the raising of profits tax by 2½%. On balance, however, chemical industry personalities I spoke to on Tuesday thought the Budget a reasonable one in the circumstances. It should not adversely affect investments, and is seen as likely to encourage exports, if only mildly.

One mystery, unsolved on Tuesday, was the proposal to take powers to require the addition of chemical markers to duty-free heavy oils, "in order to facilitate the control of such oils." None of my contacts either in the chemical industry or in the oil companies had had any advance notice of this proposal, neither do they know the reasons for its introduction. At any rate it should lead to more chemical sales!

The Government's Economic Survey, published last week, revealed that output of the chemicals and allied industries rose by 13% between the fourth quarters of 1958 and 1959 and that exports rose at an even higher rate. Over 1959, production of chemicals and allied industries was higher by 11.4%; exports rose to £293 million (£262 million in 1958). Taking 1954 as 100, U.K. exports rose to 155 in 1959 (135 in 1958, 137 in 1957 and 126 in 1956). U.K. manpower for chemicals rose by 13,000 to a total of 551,000 at end-1959.

★ THE Tin Research Institute, Fraser Road, Perivale, Middlesex, have performed a useful task in compiling a booklet which seeks to assess more than 100 patents filed in the past 25 years on the subject of organotin stabilisers for vinyl chloride plastics.

The use of such stabilisers is, of course, limited by their high cost, and the author, H. Verity Smith, examines several possibilities for cheapening them. Copies of the 28-page work are available free of charge from the institute. (*The Development of the Organotin Stabilisers;* Publication 302.)

★ THE Italian chemical industry, although by no means the largest in Europe is certainly one of the most progressive. This week comes news that 'three large industrial installations' are to be delivered this year to the Soviet Union by Montecatini. Among the plants is equipment for the production of titanium dioxide.

Count Carlo Farina, president of Montecatini, has also announced that his company is planning additional investments of 200,000 million lire during the next four years, which will double present capacities. This expansion will be accounted for mainly by increases in the outputs of petrochemicals, plastics materials, synthetic fibres and synthetic rubber.

Snia Viscosa, Milan, have reached an agreement with the U.S. Allied Chemical Co. under which the Italian firm's Lilion fibres will be produced in the U.S. Snia Viscosa will co-operate in the construction of the necessary plants and will manufacture some of the equipment in Italy. Socedison and Union Carbide, through their jointly owned subsidiary, S.p.A. Celene, plan to produce propylene oxide and derivatives at a new plant at Priolo, Sicily.

★ SOMETIMES fibre glass trespasses on preserves which traditionally belong to another basic material. I well remember the horror with which, like other weekend sailors, I received rumour of the first glass fibre small boat. No doubt most shooting men will react similarly to the notions of firearms with glass fibre barrels.

The new shotgun developed after five years' research and introduced by Winchester-Western Division of Olin Mathieson Chemical Corporation, in New York last week—the Winchester Model 59, semi-automatic—was shown to the National Rifle Association, whose members learned that the gun's barrel is spun from 500 miles of glass fibre, chemically fused, bonded to a thin steel tube.

Among the advantages claimed are that the barrel cannot rust or be affected by exposure; has double the burst strength of steel; provides cooler shooting, and lighter weight. An impressive list!

★ POWDER cutting is finding a new application in the cutting of scrap copper. The overall cost of cutting fire boxes has been more than halved. Although copper fire boxes are a valuable source of scrap, dealers have been obliged to send them away for breaking up—usually by some laborious means, such as with sledge hammers.

One scrap dealer, W. A. Musgrove, of Manchester, sought the advice of British Oxygen Gases Ltd. and as a result powder cutting equipment, fitted with Saffire nozzles, was supplied to the firm and has proved highly satisfactory. The cost of cutting copper by this method, including labour, is under 4s 6d a foot.

In the process a finely divided iron-rich powder is conducted separately to the reaction zone by compressed air or nitrogen. Combustion of the iron powder raises the temperature of the reaction, thereby increasing the fluidity of the refractory oxides, which are removed by a combined melting and fluxing action and, to some extent, by the eroding action of the iron particles. When dealwith copper and copper alloys, powder cutting is a melting process, coupled with the eroding action, rather than true oxygen cutting.

★ FIRST sale of a new Distillers ammoxidation process for acrylonitrile has been made to Ugilor of France. This process could, it is claimed, prove a more economic route to acrylonitrile than either of the two more usual starting materials—acetylene or ethylene oxide. Standard Oil, Ohio (Sohio) also have an ammoxidation route to acrylonitrile, that is described as a one-step process, which was developed independently of the D.C.L. work. Sohio are in fact building an acrylonitrile plant based on the ammoxidation of propylene.

This new D.C.L. process was referred to by Dr. Stanley at the recent Plastics Institute conference in London under the title 'Polymeric progress'—greater detail was given by Mr. D. J. Hadley, of the D.C.L. Epsom research laboratories, at a recent meeting of the S.C.I. Heavy Organic Chemicals Section (see p. 601).

This work is part of the company's policy to establish a firm process basis —processes that can be licensed for use elsewhere and used in the company's own plants. One of the best-known Distillers' processes is that for cumene-phenol, which was originated independently by D.C.L. and Hercules Powder in the U.S., and developed together.

★ ONE of the most informative books to reach my desk for some time is a new publication from Price's (Bromborough) Ltd. entitled *The Analysis of Fatty Acids and Fatty Alcohols,* it presents comprehensive data on all aspects of the subject and is based on the company's long experience in this field.

The book has been brought up to date by the inclusion of a section on gas chromatographic and u.v spectrophotometric techniques as applied to fatty alcohols. More than half the publication has been allocated to detailed test procedures set out in such a way as to be of the greatest assistance to laboratory staff in their work.

So much know-how has gone into this 150-page book that it cannot fail to be of immense value to anyone engaged in analytical work on oleo-chemicals. I am glad to say that copies are freely available from the company at Bromborough Pool, New Ferry, near Birkenhead.

★ WHERE does the money go? Of every £1 earned by the Albright and Wilson Group, 15s 9d went on labour and materials; 1s 4d on depreciation; 3d as interest on loans; 1s 3d on taxation; 1d to outside shareholders in subsidiaries; 6d on net dividends and 10d was ploughed back into the business.

Alembic

U.K. CHEMICALS WORTH £2,000m. IN 1970?

I.C.I. Development Controller on Future Pattern of British Chemical Industry

BRITISH chemical production could approach a 1970 figure of £2,000 million, based on the 1954 production census total of £765 million, assuming that price levels remain substantially unchanged.

This estimate was given by Mr. L. S. Mumford, development controller of I.C.I., in a paper on 'The future pattern of the chemical industry', presented at a symposium of the Midlands Branch, Institution of Chemical Engineers, on aspects of process economics and the chemical engineer and his position in management. The symposium was held at Birmingham University on 5 April.

In the big expansion, Mr. Mumford said that broadly speaking it would appear over the next decade that production of organic chemicals would increase about 2½-fold, while output of inorganic chemicals would rise by about 40%.

Between 1901 and 1938 statistics—which should be treated with caution—showed that U.K. chemical output rose to 2½ times its initial volume, or a growth rate of 2.5% compounded annually. From 1938 to 1948, the basis of computation was probably a little better, and the production index rose by about 70%, equivalent to 5½% a year. Data for the next 10 years, to 1958, now more reliable, showed that the volume of production had grown at an average rate of 6% a year. His figure of £2,000 million output for 1970, was based on the assumption that the growth factor of 5-6% continued over the next 10 years.

New Products

It was difficult to decide which chemicals, of those that had recently been discovered or that were now in an early development stage, would prove still to be strong 'growers' in 1970. No matter how successful a product appeared at present, it could only account for a small proportion of the vast total output value foreseen for 1970.

Man-made Fibres. On the basis of production figures up to 1960, it seemed reasonable to guess that by 1970, U.K. production of rayon will have risen to the region of 270,000 tons/year, with the truly synthetic fibres rising to about 150,000 tons/year. The estimated 1960 production of man-made fibres of 265,000 tons may, therefore, approach 420,000 tons. This would give a growth rate of 2.1% for rayon and 12.8% for the synthetic fibres.

Much was heard today of polypropylene and much hard work would doubtless be done on this. If a new fibre coming up today was in 10 years' time being produced in the U.K. at the rate of 20,000 tons, it would have progressed faster than any of its predecessors.

Plastics. Per capita U.K. consumption of plastics was considerably below that of the U.S. and Germany. It was probable that present trends would continue—a modest advance of thermosetting types and a continued faster growth rate for the thermoplastics. It seemed likely that by 1970, total U.K. plastics output might be around 1.25 million tons, of which some 75% would be thermoplastic types. That meant a growth rate of 8.7% compound a year.

It was difficult to say how this total would be divided, but the present leaders—polythene, p.v.c. and copolymers, polystyrene and polyacrylics—would have the lion's share. There was little doubt that polypropylene would be a worthy successor to polythene and would secure a substantial place in the market by 1970. Polyformaldehyde was another interesting material and more would be heard of the polycarbonates. Unsaturated polyesters were finding new applications and it was likely that the growing use of foam plastics would continue; advances were seen for polyurethane systems (in range and uses), and for foamed polystyrene and similar materials.

L. S. Mumford, I.C.I.'s development controller

Synthetic Rubbers. Mr. Mumford said that new varieties of synthetic rubbers were being developed in the U.S., notably polybutadiene and polyisoprene. By 1970, between 50-60% of the U.K.'s new rubber consumption, which would be of the order of 380,000 tons a year, might be provided by synthetic rubbers. (Synthetic rubbers took 30% of the 1959 U.K. new rubber consumption of 238,400 tons.) Assuming that by 1970 most of the synthetic requirements would be produced in the U.K., production would then be about 190,000 tons.

Synthetic Detergents. Proportion of syndets to the total detergent figure in the U.K. was about 33%, while in the U.S. it was about 75%. He expected further growth to take place, perhaps to about 40% of the total detergent market by 1970. It was probable that the types of organic surface active agents which were being used today would still basically be the types of the future, although variations would doubtless be introduced to assist sewage treatment.

Fertilsers. If one considered the total phosphate content of fertilisers, it would be seen that over recent years it had remained roughly constant at 375,000 tons P_2O_5 a year; the main change expected here was the growing output of triple-superphosphate at the expense of single superphosphate. Production of nitrogen for fertilisers was steadily growing and from a production of 341,000 tons N in 1957-58, it was possible to visualise something of the order of 450,000 tons N in 1970—a growth rate of 2.8%.

Sulphuric Acid. Based on the past 25 years' figures, production of acid had risen steadily at the rate of 4.3% compound increase. If that continued, the present production of some 2.5 million tons H_2SO_4 a year would rise to about 4 million tons in 1970.

With some of the large increases foreseen, Mr. Mumford did not feel there was much danger of running into shortage of raw materials. With the expansions visualised there was plenty of opportunity for new processes to be introduced and there were many processes being developed today which could be introduced on a large scale if the economics proved correct.

Mr. Mumford then listed some possible alternative routes:

	Main established processes:	*Recent introductions and possible developments*
	based on	*based on:*
Synthesis gas	Coke	Residual fuel oils
	Hydrocarbon gases	Petroleum distillates
Acetylene	Coke/carbide	Hydrocarbon gases; petroleum distillates
Vinyl chloride	Acetylene	Ethylene
Vinyl acetate	Acetylene	Acetaldehyde
Acrylonitrile	Acetylene + hydrocyanic acid	Propylene + ammonia
Acetaldehyde	Alcohol	Acetylene
		Ethylene (oxidation)
		Butane/propane (oxidation)
Ethylene oxide	Ethylene via chlorhydrin	Ethylene (direct oxidation)
Acetone	Propylene via isopropanol	Propylene via cumene propylene oxidation
Phthalic anhydride	Naphthalene oxidation	Xylene oxidation

Uranium Offer Withdrawn

A decisive change in the balance of supply and demand for uranium has led to the withdrawal of an offer made by the United Kingdom Atomic Energy Authority three years ago to buy chemical concentrates containing uranium oxide from mines in the Rhodesian Federation. Another offer to buy uranium-bearing ore has been reduced.

Unofficial Strike Ends

The unofficial strike of 1,000 members of the A.E.U. at the Wilton Works of I.C.I. has been called off. The stoppage followed the temporary demoting of a charge hand for alleged breach of duty and at one time threatened to involve 9,000 employees.

CHEMICALS-FROM-COAL REVIEWED AT MIDLANDS I.CHEM.E. MEETING

DURING 1954 to 1958, the quantity of spent oxide made by the gas industry varied between 270,000 and 280,000 tons a year, equivalent to about 135,000 tons of sulphur a year. Annual value of the spent oxide fluctuated in the range of £650,000 to £980,000. This was stated by Mr. A Parker at the symposium held in Birmingham on 5 April by the Midlands Branch, Institution of Chemical Engineers. He added that during the same period the cost of gas purifying chemicals purchased by the gas industry had fluctuated between £650,000 and £850,000.

Taking all costs into account, the value of sulphur recovered as spent oxide or in any other form does not cover the cost of the necessary purification of the gas to remove sulphuretted hydrogen. Mr. Parker said that between 300,000 and 350,000 tons a year of sulphuric acid (as 100% H_2SO_4) was produced from spent oxide out of a total production of about 2.25 million tons a year.

Ammonia. If all the ammonia obtained as a by-product in the gas and coke-oven industries were recovered, the annual total would be equivalent to about 140,000 tons of ammonia (NH_3) or 550,000 tons of ammonium sulphate, about one-half from each of the two industries. During the last few years, the amount of ammonium sulphate produced at coke ovens has been about 240,000 tons a year and the amount sold by the gas industry was about 80,000 tons, making an annual total of by-product ammonium sulphate of rather more than 300,000 tons. In addition, the gas industry sold ammoniacal liquor as such or as concentrated gas liquor.

Ammonium Sulphate

The value of the 80,000 tons of ammonium sulphate sold by the gas industry was about £1.35 million and the ammonia liquor sold had a value of about £300,000. On the same basis the value of the 240,000 tons of ammonium sulphate produced annually by the coke-oven industry was about £4 million.

However, receipts for the ammonia by-products barely covered the cost of converting the ammonia into ammonium sulphate, in producing concentrated gas liquor, and in the transport and disposal of crude ammoniacal liquor, particularly when the costs of disposal of liquor effluents were included. At many works the receipts certainly did not cover the overall costs.

Development of the synthetic ammonia industry had the position from the time, 40 years ago, when the coal carbonisation industries found it profitable to make ammonium sulphate as a by-product. Total U.K. output of synthetic ammonia, calculated as NH_3, was 442,000 tons, of which half was converted to 880,000 tons of ammonium sulphate, compared with an output of 310,000 tons of by-product ammonium sulphate.

Benzole. As the value per therm of gas made by the coke-oven industry was less than that of the benzole it contained, it paid the industry to recover the product. With the higher value of the gas in the gas industry it was not so generally profitable. In the past few years, the coke-oven industry had recovered some 80-90 million gall./year of crude benzole, equivalent to 3 gall. per ton of coal carbonised; the gas industry recovered only about 25 million gall./year, equivalent to 1 gall./ton of coal carbonised by the industry.

Total crude benzole stripped by both industries was about 110 million gall./year, valued (at 2s a gallon) at about £11 million.

Tar. Tar distilled in 1958 amounted to 12 million gall. About 5-7% of gas works production came from oil used for carburetting water gas. This quantity of oil-gas tar was thus no more than 3-4% of the total tar make at gas works and coke ovens. The annual average quantity of coal tar produced between 1955 and 1958 was about 2.9 million tons.

Output of U.K. Gas and Coke Industries, Amount Distilled, and Principal Products

	Year 1955	1958
	'000 Tons	
Tar (crude) produced:		
Gas works	1986	1850
Coke ovens	1034	1079
Total	3020	2929
Tar (crude) distilled:		
At gas works	496	468
At coke ovens	380	403
At tar distilleries	1902	1851
Total	2778	2722
Principal products:		
Road tar and refined tar	662	538
Creosote/pitch mixture	803	899
	Million Galls.	
Creosote oil	97	93
	'000 Tons	
Pitch	491	512
White naphthalene	9.6	6.5
Hot-pressed naphthalene	20.8	24.3
Crude naphthalene	19.6	25.1
Natural phenol	11.8	18.6
Anthracene 40/50%	2.6	2.3
Pyridine bases	369	379
	Million Galls.	
Refined cresylic acid	12.8	13.7

Quantity of tar distilled during 1955 to 1958 was 200,000 to 250,000 tons/year less than the quantity of tar produced. Much crude tar was burned as a fuel for purposes other than tar distilling; also several thousand tons of crude tar and some creosote and pitch, in the region of 130,000 to 150,000 tons/year were used as a fuel by the producers and distillers.

In recent years, the value of crude tar fluctuated from £6 to £8.5/ton. Assuming a value of £7, the total U.K. crude tar between 1955 and 1958 had an average total value of some £21 million. Total value of all the tar products was probably about £35 million. Tar was the most valuable of the coal carbonisation by-products used as raw materials for chemicals.

Allowing for costs of material, labour and other charges, there was a net income to the gas industry in the region of £12-14 million a year from the tar and tar products, and £0.1-0.4 million from the benzole and benzole products; but there was no net income from the other by-products taken together.

Discussing the Fischer-Tropsch process, Mr. Parker said that a large plant designed to produce 200,000 tons of motor spirit a year has been erected in South Africa (Sasol). Coal for this plant was available at about 6s/ton; capital cost of the plant was £35-40 million. Even with coal at that low price it had not yet been established that the process was a real commercial proposition.

Value of Products of U.K. Gas Industry in Great Britain in 1957

	Quantity sold	Value (£ million)
	Million Therms	
Gas	2,540	213.35
	'000 tons	
Coke and coke breeze	11,371	75.10
Spent oxide	226	0.69
Sulphuric acid	21	0.18
Ammoniacal liquor	94	0.30
Ammonium sulphate	79	1.34
Benzole (crude and refined)	87	3.05
Coal tar (crude)	1,404	11.42
Oil gas tar (crude)	46	0.35
Tar (refined)	97	1.06
Creosote and anthracine oil	77	0.96
Creosote/pitch for fuel	167	1.77
Pitch	114	1.23
Naphthalene (all grades)	8	0.31
Tar acids (all grades)	—	0.76
All other by-products	—	1.07
Total	—	312.94

Esso Seek Powers to Build Ethylene Pipeline

Esso's planned £800,000 Fawley-Avonmouth pipeline that will convey ethylene to the ethylene oxide, ethylene glycol and asociated products plant that I.C.I. are to build at their Severnside Works, is with three other projects to be covered by a Bill that Esso are seeking to introduce during the current Parliamentary session. Esso have plans in hand to increase their existing ethylene capacity at Fawley, which now stands at 40,000 tons a year (see CHEMICAL AGE, 20 February, p. 317).

It is intended that the Act would also empower the company to construct one or more pipelines from Fawley to Staines, an oil storage depot at Staines and one or more pipelines from this depot to London Airport.

Steetley Co.'s Dolomite Plant Nears Completion

The new dolomite quarry and processing plant at Whitewell, near Worksop, first projected over a year ago by the Steetley Co. Ltd. are now about to start operations. Cost of the new units will total some £1,600,000.

Will

Mr. Alfred Alexander King, formerly managing director of Albright and Wilson (Manufacturing) Ltd., Oldbury, who died on 15 November, aged 75 years, left £156,527 net (duty paid £91,998).

Hydrogen Production Costs Based on P. G. Experience with Recent Plants

PRODUCTION of hydrogen, town gas and synthesis gases for ammonia and methanol from liquid fuels ranging through heavy oils to light distillates and liquid petroleum gas has been the subject of much work by P. G. Engineering Ltd., a Power Gas Corporation subsidiary. Since 1955 three high purity steam hydrocarbon reforming plants operated at low pressure and one of the first partial oxidation units for high pressure production of synthesis gas from oil have been installed in the U.K. and Europe. These units are now in full operation and P. Vessey of P. G. Engineering Ltd., has reported the recent work on these plants.

Plant Ranges. Economically attractive for small capacities is the production of high purity (99.75%) hydrogen by electrolytic methods. By-product hydrogen electrolysis of brine has advantages in that main costs of production can be taken against chlorine and caustic soda.

At increasing outputs other methods must be considered, however. Where solid fuel is to be used, steam iron plant is well established. The process is a cyclic one, hot spathic ore being alternately reduced by a gas containing hydrogen and/or CO and oxidised by steam to produce hydrogen.

TABLE 1

Hydrogen Purities

Electrolytic cells ...	Guarantee figure, 99.8% (with operation figures of 99.95%)	
Steam iron process	H_2	99.0%
	CO_2	0.3%
	CO	0.4%
	N_2	0.3%
Steam iron process after CO conversion and caustic wash ...	H_2	99.6-99.7%
PG/Hercules reforming process* ...	2 stages conversion + 1 methanation	99.6%
	3 stages conversion + 1 methanation	99.7%
	Balance CH_4	0.3-0.4%
	$CO+CO_2$	<10 p.p.m.

* Actual performance figures for latest PG/Hercules units are 99.75 and 99.92% respectively.

High-purity Hydrogen. This is required for process purposes in edible oil hardening and hydrogen peroxide manufacture by the anthraquinone process; four reforming plants have been installed by P. G. Engineering. Interesting features of these plants are stated to be the redesign of the furnace to accommodate the use of oil firing, metallurgical considerations for tubes operated in the range of 1,800°F for long periods and methods of suspension of these tubes (over 30 ft in length) which increase some 6 in. in attaining operating temperature. Fabrication of the tubes has been modified to thick-walled centrifugally cast sections with no longitudinal weld giving a reduction of inherent stresses and out-of-round effects. The complete weight of the tubes and catalyst is taken by the spring suspension system, so that the tube itself is under tension throughout its length at the operating temperature.

Catalyst Studies. Suitability of catalysts has been studied, and it has been found that the fusion temperature of a suitable catalyst should be at least 500°F above the operating temperature; this condition should be met, shortly, by normal commercial supply.

P. G. Engineering have developed a suitable methanation catalyst. The operation is carried out in two vessels connected in series-parallel and the operating temperature range is 260-315°C, usually 270°C. CO and CO_2 can be reduced to less than 10 p.p.m., the company report, and for the latest unit 2 p.p.m. is reported.

Unsaturated Feedstock. Use of a special injection tube placed into the top of the reforming tubes, whose basic function is to bring the feedstock into intimate mixture with superheated steam and raise the whole rapidly in temperature before passing to the reaction zone, has enabled unsaturated feedstock containing up to a maximum 30% to be employed.

Discontinuous Operation. For a five-day week operation, pipework and operating characteristics of the furnace have been modified so that, over the week-end period, steam and hydrogen are recycled through the tubes which are maintained at slightly below normal operating temperature.

H Purification at Low Temperatures. Final purification of 98-99% hydrogen steam at 20,000 cu. ft./hr. to give a high purity hydrogen (99.99+%) with CO impurity at less than 10 p.p.m. and hydrocarbons at less than 75 p.p.m. has been reported. Vessey states that at present the cost of such an installation is not available. The interesting feature of this process is that a low purity H stream can be used as feed, and one or more normal purification steps may be excluded, so reducing costs.

TABLE 2

Comparative Utility Requirements per 1,000 s.c.f. H_2 lower capacity range (s.c.f. measured at 30 in. Hg and 60° F saturated)

Electrolytic plant (99.8% purity)	150kWh	
	10 gall. distilled H_2O	
Steam iron—conversion and caustic wash 99.6% purity	Coke	51-61 lb.
	Steam	260-200 lb.*
	Labour	3 men
	Overheads	as 100% labour
	Power	3.8 kWh
	Caustic	1.2 lb.
	Iron ore	1.0 lb.
	Catalyst	0.025 lb.
	Water	600 gall.
	* At smaller capacity no boiler jacketed generator and waste-heat boiler—lower coke demand, higher steam demand.	
PG/Hercules—2-stage conversion and methanation (99.6+% purity) ...	Propane	12.3 lb.
	Fuel	2.2 therms
	Steam	280 lb.
	Labour	1 man
	Power	0.5kWh.
	Water	1,000 Imp. gall.
	Reforming catalyst	0.002 lb.
	Conversion	0.02 lb.
	Methanation	0.01 lb.
	M.E.A.	0.02 lb.

Pressure Cells. Detailed information on pressure operation of electrolytic cells delivering at approximately 30 atm. achieves a 30% reduction in voltage requirements/1,000 cu. ft. of hydrogen.

Comparison of Costs. Table 2 compares total production cost of high-purity hydrogen in operating range up to 25,000 cu. ft./hr. for electrolytic, steam iron and reforming plants. For electrolytic plant, cost of production is related very much to cost of power. For steam iron plant at larger capacities than about 25,000 s.c.f./hr. it is suggested that a boiler jacketed generator and a waste heat boiler should be installed. For reforming plants P. G. Engineering consider fixed charges at 17½% to cover depreciation, interest and maintenance.

TABLE 3

Cost of Utilities

Coke—75% carbon	£7/ton
Propane	£30/ton
Fuel for heating	7d./therm
Steam	17s. 6d./ton
Labour	4s. 6d./man-hour
Power	1d./kWh
Fixed charges—17½% for depreciation, interest and maintenance.	

Using above figures for utilities and fixed charges, overall production costs are obtained for a plant to produce 25,000 s.c.f.H./hr.

Steam iron	132d./1,000 s.c.f.
Reforming	120d./1,000 s.c.f.

Belgian Texaco Plant. P. G. Engineering have recently installed a two-generator Texaco plant in Belgium, which is now in operation. It operates at high pressure (about 15 atm.) for CO conversion using catalyst manufactured by the company. As sulphur is removed from the synthesis gas prior to conversion, gas from the generator has to be cooled down before H_2S removal. When no sulphur removal before conversion is necessary, the gas is passed directly from the generator through heat exchangers to conversion but without steam recovery or a saturator and a similra overall recovery is obtained.

TABLE 4

Belgian Texaco Plant

Feed	Heavy fuel oil	
Gas analysis—exit water scrubber.		
	$COS+H_2S$	1.0% vol.
	CO_2	4.9 "
	CH_4	0.2 "
	N_2	1.4 "
	CO	47.5 "
	H_2	45.0 "
Gas yield	104,000 s.c.f. of $CO+H_2$ per ton of fuel oil to process.	
Oxygen consumption	255 scf./1,000 s.c.f. of $CO+H_2$	

Carbon Removal. Carbon is recovered from the water stream by extraction and decantation, the carbon being recycled to the generator.

High-pressure Reforming. At present P. G. Engineering are engaged on a project for high-pressure reforming. The main advantage of this process arises when the final gas is required at pressure as for ammonia synthesis.

H.P. H v. Synthesis Gas Costs. In general, Vessey reports, the capital cost of partial combustion and reforming units is not dissimilar, although operating costs show an advantage in favour of partial oxidation units. The partial oxidation process, however, can be operated on a wide range of feedstock. The process is therefore being installed for production of large quantities of gas for normal town gas purposes.

SILICONE PROCESS FEATURED IN REPORT ON MIDSIL

BELIEVED to be one of the most difficult separation processes at present carried out on a production scale in the chemical industry is the fractional distillation employed by Midland Silicones Ltd. (who celebrate their 10th anniversary this year) at their Barry, Glamorgan, silicones plant to separate the mono- and dimethyl chlorosilanes resulting from the initial methyl chloride-silicon reaction. This requires very close control, as the boiling points of these two chemicals are only 4°C apart.

A pure, silicone rubber polymer, this soft, gelatinous material, almost transparent, is made and handled by Midland Silicones under conditions of strict cleanliness.

In the production of silicones methyl chloride vapour is passed over powdered silicon metal at about 300°C in the presence of copper as catalyst. A mixture consisting largely of trimethyl chlorosilane, dimethyl dichlorosilane and methyl trichlorosilane results. In the next stage of production the three constituents are blended and hydrolysed. The dimethyl dichlorosilane units with their two reactive chlorine atoms form the basis of the long chain-like molecules, the methyl trichlorosilane with its three reactive groups leads to the formation of three-dimensional linkages, while the trimethyl chlorosilanes serve as 'end-blocking' units to prevent further linear growth of the polymer.

This information is contained in a review of Midland Silicones Ltd. published in the annual report of Albright and Wilson Ltd. (see also CHEMICAL AGE, 2 April, p. 570).

Royal Dutch/Shell Spent £43½ million in U.K.

BUSINESS placed with British industry by the Royal Dutch/Shell Group of companies during 1959 was worth £43½ million, £4.5 million above the 1958 total. The year's business was distributed among nearly 3,000 British suppliers, five of whom received orders of over £1 million in value.

Major purchases included some £14 million on bulk chemicals and catalysts, £3½ million on specialised equipment for oil drilling and production, £4 million on drums and tinplate and another £4 million on tubulars, pipe fittings and valves.

Users Attend Autoanalyzer Course

Organisations purchasing an Autoanalyzer from Technicon Instruments Co. Ltd. are invited to send a qualified chemist for a course of instruction in the company's London laboratories. Mr. L. J. Evans, managing director, is seen here with course members S. C. Welshman of Belfast City Hospital; Miss C. Wincey, Chemical Pathology Department, King's College Hospital; Miss A. J. McDonald and R. E. Stanton, Imperial College of Science and Technology; B. E. Northam, General Hospital, Birmingham; A. L. Abbott, Central Laboratory, Portsmouth; and Dr. A. L. J. Buckle, technical director of Technicon

In Parliament

More Questions on Germ and Chemical Warfare

FURTHER questions were raised in the House last week on the subject of chemical and biological warfare, after it had been revealed (see CHEMICAL AGE, 2 April, p. 566) that information regarding new methods of chemical or germ warfare had been supplied to the U.S., which is not a signatory to the Geneva Convention on poison gas.

In response, Mr. Watkinson, Minister of Defence, stated that information of this kind is exchanged with the U.S. "under the normal arrangements" to assist development of an effective defence. "No restrictions are placed on the use which either country may make of the information for its own purposes." Arising out of a further exchange, on the subject of production of such materials by the U.S., Mr. Silverman gave notice that "in view of the very unsatisfactory reply" he would seek an opportunity of raising the matter on the adjournment as soon as possible.

Testing of Sprays and Chemical Fertilisers

In response to a recent question on the subject of the advisability of forming a new body to carry out tests of commodities such as sprays and chemical fertilisers, the Parliamentary Secretary, Ministry of Agriculture, said that the present statutory and voluntary arrangements are adequate. Such arrangements are kept under review to ensure they are in step with developments.

When the matter was pressed further, Mr. Godber responded that the Fertiliser and Feeding Stuffs Act stipulates that agricultural producers must be provided with information about the composition of such commodities when they buy them.

Joint Plastics-Rubber Research Association

The British Plastics Federation is not sponsoring a joint research association for the rubber and plastics industry as was stated in a heading to our report of the federation's annual meeting (CHEMICAL AGE, 26 March, p. 532), but has been studying the question and is acting as a 'clearing house' for the views of its members. It is also in contact with the British Research Association for the Rubber Industry on the subject.

Corrosion-Resistant Plastics in Printed Circuitry

The corrosion resistant Keebush and Keeglass structural plastics materials are now being used for the spray etching of printed electrical circuits in a design by the Kestner Evaporator and Engineering Co. Ltd., London.

The thin metal is bound to the plastics base, and the latter has to resist the corrosion effects of the spray of etching fluid, and those of the washing sprays, which are followed by drying.

Design of Rotary Coolers and Dryers in Fertiliser Plants

Fisons' Paper at F.S. Meeting

PERFORMANCE tests carried out on rotary coolers in fertiliser plants and small-scale experiments on the behaviour of granular solid materials falling from lifting flights were described by S. J. Porter and W. G. Masson, Fisons Fertilizers Ltd., in a paper—'Rotary coolers and dryers—some related aspects of design' read at a recent meeting of the Fertiliser Society.

Following a literature survey on rotary dryers, a provisional design method was evolved. The rotary dryers were equipped with straight, longitudinal lifters, parallel to the axis rather than helical. The lifters were either flat or angular in section. The modified coolers have now been in use for two years. Quantities determined in full scale tests were: heat transfer coefficients (in all cases); hold up or residence time; and air pressure drop.

Heat Transfer. The conclusion of Saeman and Mitchell (*Chem. Eng. Prog.*, 1954, **50**, 467) that heat transfer coefficient is proportional to the cascade rate has not been confirmed. For a given feed rate the cascade rate can be increased by increasing flight area, number of flights or dryer speed. The effect of increasing the first of these is to reduce the effective volume of the drum while the effect of increasing the rotational speed is to decrease hold-up.

Discrepancies

Because of discrepancies hold-up and the quality of the solid distribution in the air stream, two factors which are interrelated, were selected for further study.

Hold-up. The equation of Saeman and Mitchell $H = \frac{FL}{f(H)ND(S-mv)}$ or its equivalent $T = \frac{L}{f(H)ND(S-mv)}$ has been found to fit practical results quite well. Once the value of m has been found the residence time for any cooler or dryer can be calculated with an error of perhaps ±25% at the outside.

Results can be extended to co-current machines with success, Porter and Masson report, if the gas velocity is regarded as negative in these cases. The term in brackets in the denominator of the expression for H or T can be regarded as a hypothetical equivalent slope which would give the same rate advance through the machine at zero gas velocity, i.e. the gas flow may help (co-current) or hinder (counter-current) the movement of solid down the slope. The equation even covers the case of solid flow up the slope of a reverse tilted machine at high co-current gas rates.

Operation was found to be quite satisfactory up to an air velocity of about 9 ft./sec. counter-current. At rates more than slightly greater than this, an unexpected phenomenon was found. One cooler was originally worked at air velocities of 10 ft./sec. or rather more and not only was hold-up sharply increased compared with velocities of 9 ft./sec. and less, but the flow pattern of solid was completely changed. From the normal arrangement of full flights with a small rolling bed, the solid re-arranged itself to resemble a series of dunes moving down the cooler, and there was an efficient classification of particle size at the same time. The material appeared on the conveyor after the cooler as a succession of heaps rather than a continuous layer. There was even a noticeable difference in chemical analysis between the heaps and valleys on the belt as a result of segregation of the salts into fines rather than oversize. A reduction in air velocity gave satisfactory operation of the cooler.

Saeman and Mitchell had suggested that the extreme value of f(H) corresponded to the extreme types of transport mechanism and that $f(H) = 2$ when the drum is lightly loaded and with no rolling bed, and $f(H) = \pi$ when the drum is heavily loaded, flights are small and kiln action predominates. Porter and Masson suggest, however, that a more drastic change of action is involved, and that in a flighted drum with a heavier load the action of the gas on the cascading material upsets the smooth kiln action which would occur in a flightless drum. A full explanation of the matter is still required.

Pressure Drop. In this field, very little work appears to have been done, Porter and Masson note. Results obtained had shown a quadratic relationship of pressure drop against airflow. Two other major variables which were considered to be affecting pressure drop were cascade density and the quality of solids distribution.

Heat Transfer Co-efficient

In analogy with variation of mass transfer with pressure drop in packed columns the heat transfer co-efficient has been plotted against pressure drop per unit length of cooler. The difference in slope has been found to be still apparent, although less pronounced and there was a measure of agreement at pressure drops of the order of 0.01 in. W.G./ft. suggesting there might be a point analogous to a loading point where material entrainment becomes evident.

Coolers. In the present state of knowledge, say the authors, heat transfer characteristics of a rotary cooler can best be described in terms of a volumetric heat transfer co-efficient based on the effective volume of the cooler which is the portion of its volume within the ring of flights traversed by air current. It is not yet possible to separate this group—Ua—into two terms U, which is a heat transfer co-efficient based on the solid surface area, and a, the surface area of solid per unit effective volume of the cooler. The familiar correlations of Ua in terms of geometric shape, slope and speed of the cooler drum are not sufficient by themselves, it is reported, to predict the heat transfer co-efficient for a new design. Working hold-up and distribution pattern of the granules in the air stream are believed to influence the heat transfer and pressure drop characteristics of the machine.

These workers have found a measure of optimum hold-up for a given speed of rotation and flight profile. It is too soon to say that the most uniform distribution pattern measured in small scale experiments is necessarily the optimum of heat transfer. There appears to be a combination, Porter and Masson say, of cascade density and gas velocity which is analogous to the loading point in a packed column and this may be the point at which to aim in design.

Dryers. Work of van Krevelen and Hoftijzer (J.S.C.I., 1949, **68**, 59) indicated that for granular compound fertilisers the controlling resistance in drying is the diffusion of water through the increasing layer of crystalline salts on the surface of the granule and that the rate of this stage of drying may be up to 1,000 times smaller than that of a granule without the crystalline deposit. Other work supports the view although the ratio of rates may be measured in hundreds rather than thousands. Therefore in the design of the dryer the most important single factor, state Porter and Masson, is residence time under drying conditions and the efficiency of contact between gas and solid, while important, is not the governing factor.

Economic Design

Design. As a first approximation to an economic design for a cooler using atmospheric air as the cooling medium, Saeman and Mitchell's statement that the heat transfer co-efficient is proportional to the cascade rate has been used, bearing in mind that the statement is true over only a limited range of cascade rates. An optimum ratio of air velocity to solid rate has therefore been sought. The air rate has been expressed as a multiple of the theoretical minimum.

The curves thus obtained are found to be fairly flat around their minima and until more fully understood, the indicated optima of about 1.3 by minimum air for minimum capital cost, 1.4 by minimum air for minimum total cost and 1.5 by minimum air for minimum power might well be used as a basis for design of coolers. In the case of dryers, the cost of fuel must be taken into account. When the air rate is chosen, the diameter of the machine can be fixed using the limiting air velocity as a guide. Speed of rotation and a slope have to be chosen which are both mechanically satisfactory and such as to give a hold-up close to the optimum for chosen speed.

It is suggested, too, that the counter-current machine be given a slope of about 3° and the co-current machine be made horizontal so that the other mechanical conditions, such as speed and diameter, can be identical and the hold-up will prove satisfactory in each case.

FOSTER-WHEELER ENGINEER NOVEL TWO-STAGE VACUUM DISTILLATION UNIT

THE new 100,000 barrels a day three-stage crude distillation unit that Foster-Wheeler constructed for Mobil Oil at their Beaumont, Texas, refinery is the first such unit; it also has facilities for naphtha return and stabilisation. It has an atmospheric stage and two stages of vacuum, a unique feature, with direct-fired heaters for vaporisation.

When planning the development programme, Mobil engineers arrived at four important conclusions: (1) the operational efficiency and flexibility of solvent refining is substantially improved if lube distillate feeds possess a narrower boiling range, i.e. if they are 'closer cut'; (2) while fractionation in single vacuum columns is adequate to produce lube distillate side streams meeting viscosity, colour and flash specifications, it is not adequate to produce closer-cut side streams of comparable viscosity; (3) two stages of vacuum, with independent vacuum systems, would produce substantially closer-cut lube distillates, and (4) a two-stage vacuum section could be built and operated at about the same total cost (investment and operation) as for a one-stage section.

Foster-Wheeler studies confirmed this point. Even if investment costs were greater for the two-stage vacuum unit, expected savings from improved operation of the downstream processes (solvent refining and dewaxing) would subsequently offset the increase within a comparatively short period.

Four Side Streams

Mobil's design provided, therefore, for two vacuum stages and boiling range specifications were set up for four lube distillate side streams which Foster-Wheeler guaranteed and met.

Main reason for the substantial overlaps and indicated inferior fractionation between lube distillates as produced from most single-stage vacuum columns is the inability to reduce the operating pressure to that point where sufficient vaporisation is effected to provide adequate reflux ratios and the maximum ratio of hydrocarbon vapour/process steam in order to minimise combined vapour velocity.

The common practice to compensate for this insufficient vaporisation of the feed as it enters the column is to use large quantities of process steam which, in turn, raises vapour/steam velocity up the column in excess of the optimum rate conducive to good fractionation.

The problem, therefore, of producing closer-cut lube distillates resolved itself into one of providing the lowest practical operating pressure (absolute) or the highest vacuum in that section of the column where the lowest pressure is needed, i.e., the section where the highest viscosity lube distillate is produced.

Flow Description. From storage, the crude is pumped into a dual-circuit heat-exchanger train, separated into two sections; before and after desalting. The crude, preheated to about 260°F, enters the desalters where salt is removed electrolytically. The desalted crude is then pumped into the second section of the dual heat-exchanger train.

Preheated to about 425°F, each of the two crude streams enters its own direct-fired heater where the temperature is raised to 680-700°F to provide adequate vaporisation for the fractionation in the atmospheric column. Five intermediates and a residue are separated in the column. The reduced crude is pumped from the bottom of the atmospheric column through a direct-fired heater 750°F and the resulting vapour/liquid mix enters the No. 1 vacuum fractionating column where three intermediates and a residue are separated. The top-of-column liquid stream splits and may be pumped either to storage or back to the atmospheric column for re-running or reflux control in the lower plates of that column.

Residue from the first-stage vacuum column is pumped through a direct-fired heater where it is raised to 750°F; the resulting liquid/vapour mix enters the final vacuum stage where three intermediates and the final residue are produced. Top-of-column stream is pumped back to the lower section of No. 1 vacuum column for re-running to maximise yields. A part of the heavy lube distillate stream from No. 2 vacuum column is also used as reflux control in the lower plates of that column.

Sulphur Should Flow This Week from Grand Isle, World's First Off-shore Plant

SULPHUR was expected to begin to flow this week from the Grand Isle dome of Freeport Sulphur which is sited 7 miles off the Lousiana coast in the Gulf of Mexico. The company believes that this, the world's first off-shore sulphur plant, will eventually become its lowest cost unit. The sulphur rights at Grand Isle were acquired from the Humble Oil Co. in 1956 and this company will receive 50% of the net profits from the operation.

The heating unit is designed to deliver an average of 5 million gall. a day of water at a temperature of 325°F, with a maximum in excess of 5.5 million gall. a day. It is estimated that Grand Isle plant should be capable of producing from 2,500 to 3,300 tons a day of sulphur, based on a water ratio of 1,500 to 2,000 gall. per ton.

Extent of the estimated reserves of the underwater sulphur dome is not known, but the company has indicated that it is the third largest sulphur deposit in the U.S. (*Chem. and Engng. News*, 1960, **38**, No. 13, 30).

Sulphur produced at Grand Isle will be transported to shore in a 7-mile pipeline buried about 5 ft. below the bottom of the Gulf. With a capacity of 4,500 long tons a day, the pipeline takes molten sulphur to the Louisiana coast where it is transferred to barges for transporting to Port Sulphur, 25 miles away. The pipeline contains three concentric pipes: a 14-in. o.d. protective casing, a 7¾-in. o.d. hot water jacket line, and a 6-in. o.d. sulphur line. Sulphur will enter the pipeline at 320°F, and will, despite insulation and an air gap, drop in temperature to 280°F by the time it reaches shore. It is estimated that the heat loss may reach 75 million B.t.u. a day. Two additional pipelines will return spent heating water to the mine and provide a limited source of fresh water to the plant.

The Y-shaped steel 'island' rises 60 ft. above normal water level, a height dictated by the fact that it lies in a well-known hurricane area; these high winds can generate waves up to 45 ft. high. One platform houses the steam generating plant, warehouse and shops; another the office and living quarters. From them, steel bridges branch out to two drilling platforms, only one of which is so far completed. Each platform has openings to drill from 36 surface locations on 11-ft. centres. No more than 12 will be used at one time.

Seawater at 75°F is sprayed into the top of preheater towers and percolates down through two beds of ceramic rings. The upper bed raises water temperature to 140°F by contacting stack gases flowing up from the boilers. The lower bed raises the water temperature to 190°F with heat from six air-gas premix burners. The water is then picked up by high-pressure centrifugal pumps and forced through 20 heat exchangers to complete the heating process and to raise the temperature to 325°F and 400 p.s.i.g., sufficient pressure to force it into the wells.

New Timber Preservative Described in Lecture

A NEW technique originally developed in the U.S. for eradicating rot, woodworm and termites from infested timber was described in a recent lecture given by Mr. D. Boocock, technical director of Standardised Disinfectants Co. Ltd., Oak Lane Works, London, E.14, to the Industrial Pest Control Association, London.

The technique depends on a new type of preservative in the form of a thick emulsion which although applied to the surface of the timber nevertheless penetrates to the seat of the infestation, leaving behind sufficient preservative to ensure long term protection from reinfestation. The process is as simple as spraying, and one application is said to be equivalent to at least 20 brush or spray applications.

New Plastics Filter Material Removes Sub-micron Particles From Fluids and Gases

MEMBRANE filters, composed of a thin plastics material having tiny uniform holes in it are in use in the U.S. for removing sub-micron particles from fluids and gases. Developed by Gelman Instrument Co., Chelsea, Michigan, this new-type filter has holes or cavities occupying more than 80 to 85% of the filter volume. The membranes are made in different grades with holes ranging from 0.2 micron to 10 micron in size.

Two methods of filtering action take place when the membrane filter is used to filter air or gas streams. The first is an actual sieving action. All particles larger than the pore size of the filter stay on the filter surface. The second action results from a strong frictional electrostatic charge which builds up on the filter. Particles much smaller than the filter pore size are thus collected because of this electrostatic charge.

The fact that particles are retained on the filter surface has made the membrane filter an ideal method for concentrating fine particles from fluids and gases, it is reported. After concentration, the particles can be viewed directly on the filter

These Gelman membrane filters are composed of cellulose esters, principally cellulose nitrate, and are produced in a similar manner to plastics film. Pore size and flow characteristics are tested to conform with desired properties. Thickness of the membrane varies from 7 ml. to 15 ml. depending on type. As would be expected the larger pore size membranes are also the thicker ones. The filters are flexible and stated to be of fairly high mechanical strength.

Flow Rates

A membrane AM-I with pore size 7.5±2.5 allows flow rates (cc./min./an.-700 mm. Hg.) for air of 130,000 and for water, 740; some types are available with a printed grid, and some are supplied grided, specially for sanitary water analysis.

Using specially developed holders samples of dusts on aerosols can be collected on the membrane by drawing air through the filter at a known rate. A flowmeter or flow control device in the sampling system is advocated.

Radiochemists are reported to make good use of the membrane filter in determining radioactive particles in fluids and air. Since the filter retains all particles on its surface, very little correction is stated to be necessary for self-absorption of the filters when measuring weak α- and β-emitters. Radioactive particles can be differentiated from inert particles by making a contacts autoradiograph of the membrane filter. Nuclear track emulsion is exposed on top of a membrane and after development the film can be superimposed on the membrane and examined with a microscope.

Membrane filters may be used wherever it is necessary to have either fluids or gases absolutely free of particles. Unlike fibrous filters there is no dependence of filtering efficiency on face velocity. The filter media itself cannot dislodge and contaminate the stream being filtered.

An in-line filter holder has been devised by Gelman Instrument to test efficiency of dust collector systems. Room dust may be used as a test aerosol or a tracer may be introduced to the system. Fluorescent test aerosols are now frequently used. In this case a black membrane filter is employed and the filter viewed under UV light. The fluorescent particles can be easily counted.

Inertness of the membranes make them suitable for sampling corrosive process effluents. The sample stream has to be cooled to 100°C or less before collection, however, since the membrane shrinks above this temperature. Also if the stream is heavily laden with steam, the membrane will clog.

The finest colloidal systems can be filtered with the membrane filter and particles filtered from air, fuel gas, or liquids, can be spot tested on the filter for qualitative identification. Millimicrogrammes of material can be thus identified. Bacteriologists have used membrane filters to quickly concentrate and identify micro-organisms, and the method has been adopted by the U.S. Public Health Service for bacteriological examination of water, on the grounds of speed and economy of personnel and equipment. In the medical field, the filters have been used to cold sterilise serums, vaccines and other biological materials. Air and gas supplies to tissue culture and to test chambers can be similarly cold sterilised while the food and beverage industry is using the filters for sterilisation of fruit juices and drinks.

In the laboratory, membrane filters have been used to filter colloidal suspension of, for example, fine hydroxides, freshly precipitated silver chloride, etc. For chemical analysis, of the deposit, the filter can be dissolved in a suitable solvent such as methylacetate, acetone, or 96% methyl alcohol. Or the filter can be wet or dry oxidised.

Agents for Gelman Instrument Co. in Europe are B.I.R.N. S.A. 1026-1048 Chaussee de Louvain, Brussels 14, Belgium.

Development in Platinum Plating Gives Direct Stable Deposits

THE corrosion resistance of platinum, coupled with its ease of deposition, have been employed by Johnson, Matthey and Co. Ltd., 73 Hatton Garden, London E.C.1, in conjunction with a new type of plating bath, to achieve bright, heavy and coherent deposits directly on to copper, brass, silver, nickel, aluminium and titanium, though for deposition on tin, zinc, cadmium or steel an undercoat of silver or nickel is necessary.

This bath, known as DNS platinum plating solution, is based on the complex sulphato-dinitrito-platinous acid, $H_2Pt(NO_2)_2SO_4$, and patent applications covering electrolytes of this type have been filed in a number of countries.

The bath is acidic, and may therefore be used successfully on electrical components and on printed circuits. Deposits from the new bath are "exceptionally bright and lustrous at all thicknesses, and no polishing is required". Electrographic tests have shown no evidence of porosity in deposits up to 0.001 in. in thickness on polished copper. Above this thickness some slight evidence of cracking may be observed. At a current density of 5 amp./sq. ft., and at 50°C, the deposition rate is 0.0001 in. in two hours.

The bath gives bright, smooth deposits over a wide range of operating conditions. Deposits may readily be obtained up to 0.001 in. in thickness, and the bath gives consistent and reliable performance.

Aromatic Fluorines Produced by Radiation

INTERESTED in research on radiation chemistry for its potential value as a process technique is Dr. Paul Feng, supervisor of chemical physics at Armour Research Foundation of Illinois Institute of Technology. He reports that he has found a method of making aromatic fluorine compounds with radiation, and believes that it will prove to be a relatively easy route to chemicals that could not be made by standard chemical means.

Working mainly on the fluorination of nitrobenzenes, Dr. Feng has so far prepared three or four fluorine-containing substituted benzenes, and has isolated *m*-fluoronitrobenzene. Carbon tetrafluoride is used as fluorinating agent, avoiding saturation or destruction of the benzene ring, which usually occurs when fluorine gas is used.

Whatever method is used to prepare these compounds, the fluorinated aromatics are not cheap. Dr. Feng estimates that they cost $50 to $100 a pound. So far, all his work has been on a laboratory scale and he has made less than a gramme of these compounds.

It is considered that the fluorinated aromatics may have valuable properties and the U.S. Army is supporting Dr. Feng.

Chemist's Bookshelf

DEVELOPMENTS IN DTA

DIFFERENTIAL THERMAL ANALYSIS. By *W. J. Smothers* and *Y. Chiang*. Chemical Publishing Co., New York, 1958. Pp. 444. $16.00.

Differential thermal analysis (DTA) like many branches of analytical chemistry has developed rapidly in recent years. Originally, it was applied mainly to minerals and oils but, to-day, it finds use in the fields of chemistry, geology, ceramics, metallurgy and soil science. The growth of DTA has created the need for a review of the vast amount of literature on the subject and, it is, therefore, with particular interest that this book, the first comprehensive review, is welcomed.

Of the 444 pages in this volume, the text covers only the first 147. The remainder contains over 1,500 references on all branches of the subject from all sources including Russian, a directory with details of DTA equipment, names of users and notes on the applications in various laboratories throughout the world.

In the text there are eight chapters. The first chapter describes the development of the early forms of DTA apparatus used in the study of clays and the history and further development of the technique in metallurgy, ceramics, inorganic chemistry, soils and other fields. This is followed by a chapter on equipment which gives a complete description of the sample holder, thermocouples, furnaces, heating rate control, recorders, special equipment, and ends with a tentative recommended practice for the thermal analysis of metals and alloys according to the A.S.T.M. specification E14-51T.

Factors in qualitative work are then considered and, in chapter four, selected applications of qualitative DTA are covered, concluding with a discussion of other qualitative techniques such as X-ray and chemical analysis, microscopy, dilatometry, which may be used to assist in the interpretation of DTA results. In chapter five, N.F. Tsang develops the theoretical background of quantitative DTA and, in the last three sections, quantitative DTA, the use and correlation of results, and recent developments are discussed in that order. Following the publications on DTA and the information on the equipment, which are contained in appendices 1 and 2, two very valuable appendices are given. One provides an index of operators of DTA equipment throughout the world and the other an alphabetical reference list of materials studied by DTA.

This is a very interesting and useful book, and its interest is increased by the fact that, at last, the reviewer has found American authors who have written at an international level by including the work of others besides Americans. It will be appreciated that, in view of the enormous literature field covered, the authors make little attempt to provide a critical appraisal of the published work.

R. J. MAGEE

Theilheimer on Synthetic Organic Chemistry

SYNTHETIC METHODS OF ORGANIC CHEMISTRY, Vol. 13. By *W. Theilheimer*. S. Karger, Basle, 1959. Pp. XVI+600. Sw. Fr. 112.

'Theilheimer' has become a well-established annual series and many organic chemists will already have browsed through this new volume with much pleasure and profit, even though it is primarily designed as a reference work. Like the previous volumes, this book consists mainly of abstracts of preparative procedures. These generally provide sufficient information for an appraisal of a synthetic method; the original papers must be consulted for detailed preparative recipes. The present volume refers mainly to papers published between 1956 and 1958.

As in the previous books in this series, the reactions are indexed according to the bonds formed and broken, and they are designated by reaction symbols, following a system devised by Weygand. Some chemists find this system rather difficult to remember, but fortunately its use can often be avoided by consulting the subject index, which lists starting materials and products, as well as reagents and the names of reactions. The index in volume 13 is cumulative, covering volumes 11-13.

'Theilheimer' is widely appreciated as a powerful key to the rapidly expanding literature of preparative organic chemistry and it is therefore sufficient to say that volume 13 comes up to the high standard of its predecessors. Like the more recent volumes, it contains a valuable brief review (5 pages) 'Trends in synthetic organic chemistry 1959'. This highlights some points of special interest and calls attention to developments too recent for inclusion in the body of the text. The preparation of olefins by hydroboration of acetylenes, the use of ruthenium tetroxide as an oxidising agent and recent procedures in nucleotide and peptide chemistry are among the topics included in this review.

The series as a whole is clearly an asset to any library of organic chemistry and it is unfortunate that the high price of this volume will prevent it from reaching many private bookshelves.

PETER SCHWARZ

Reference Book on Monohydric Alcohols

SOURCE BOOK OF INDUSTRIAL SOLVENTS, Vol. 3. Monohydric Alcohols. By *Ibert Mellan*. Reinhold Publishing Corp., New York; Chapman and Hall, London, 1959. Pp. VI+276 (57 Tables) 80s.

Third in a series this volume presents the physical properties, azotropic mixtures and uses of industrial alcohols. Like the previous volumes it is an excellent reference work and a convenient and handy source of information.

In an historical survey is described the early production by malting and brewing, and present day synthesis, Fischer-Tropsch, iso-synthesis, oxo process and the oxyl process. The book must be considered, unbalanced, however, in that such a large part (74 pages) deals with ethyl alcohol. Also, many would question the author's inclusion of the oxo process (14 pages) in this chapter. The introduction to ethyl alcohol also leaves much to be desired in a technical reference work of this type, particularly the lay-style of writing giving the historical background to the discovery of alcohol.

Returning to the question of balance, the few pages devoted to methanol manufacture (8 pages) will undoubtedly surprise, as will the two and a half pages each devoted to *n*-butyl alcohol and isopropyl alcohol. In the case of the latter solvent, only one short paragraph deals with production methods. Throughout the book, no attempt has been made to cover manufacturing methods, which in a book of this type is to be regretted.

The book is printed in the type-face that suggests a photo-copy of a typewritten report. Lack of headings to the text matter does not make for easy reading, while the index must be considered thin.

It should prove useful to the industrial chemist, though the absence of detailed manufacturing methods and rather unfortunate style of writing may annoy.

D.L.M.

Rubber Research Grants for U.K. Universities

THE Universities of Glasgow and North Staffordshire and the Imperial College will share, with four Continental universities, 1960 research grants totalling $120,000, donated by the U.S. Rubber Research Centre. The universities on the Continent are those of Utrecht, Liege, Strasbourg and Aachen.

Research carried out under the grants, which began in 1956, include basic studies of the properties of polymers and colloids and the mechanisms of creation and ageing of new fibres, plastics and types of rubber. An expansion in engineering science is planned.

The U.S. Rubber Research Centre is supported by the U.S. Rubber Company whose British affiliates carry out extensive applied research.

Two New Books for Analytical Chemists

To provide the routine analyst and student with all the data which he is likely to require in the laboratory, Dr. J. R. Majer, Department of Chemistry, University of Birmingham, has produced the *Analysts' Pocket Book*. It supplies quantitative information to the analyst in a simple and compact form. Included in the contents much of which are in tabular form are, besides atomic weights, chemical factors for all the usual metals, equivalents of volumetric solution, primary standards, standard solutions indicators, pH values of common reagents, ionisation constants of acids and bases, solubility products, buffer solutions, preparation of laboratory reagents, hydrometer conversion, concentrations of the commoner acids and alkalis, densities of alcohol water mixtures, water, and mercury, conversion tables, logarithms and a short but useful bibliography.

Analysts' Pocket Book is published by Butterworths Scientific Publications at 17s 6d.

Iodine Tests and Reagents in Chemical Analysis is a new publication by the Chilean Iodine Educational Bureau, Chile House, Ropemaker Street, London E.C.2.

Detection of sodium sulphate in meat, identification of mercerised cotton, differentiation of boiled and unboiled milk, and the qualitative determination of mercury, thallium, selenium, blood sugar, and benzathine, are some of the techniques described.

Tests and reagents are numbered and grouped alphabetically according to names of elements, radicals and compounds detectable. Where more than one procedure is available the arrangement is based first on the year of origin of the relevant scientific paper and second on the name of the author (an author index is provided at the back of the booklet).

Hickson First to Use X-ray Analysis Method

A NEW X-ray technique for analysing and testing timber preservatives and flame retardants has been installed by Hickson's Timber Impregnation Co. (G.B.) Ltd., at their Castleford, Yorks, laboratories. The Philips all-vacuum X-ray fluorescence spectrographic apparatus, is the first of its type in the U.K. and the first to be used exclusively in timber research. It accurately completes in under 10 minutes, analyses which formerly took a day and a half by the more usual destructive methods using chemical techniques.

It is currently being used to analyse Tanalith and Pyrolith solutions from plants all over the world, to check samples taken from impregnated timber already in use, and to answer specific queries raised by new development work.

Although the purchase of this equipment meant an investment of £6,500. Dr. D. S. Belford, head of Hickson's Timber Impregnation research section is confident that it is money well spent. In fact already the X-ray spectograph is on a continuous operation basis.

Chemist's Bookshelf

TEXT-BOOK OF ORGANIC CHEMISTRY

LEHRBUCH DER ORGANISCHEN CHEMIE. By *Paul Karrer* and colleagues. 13 Edit., revised and enlarged. Georg Thieme Verlag, Stuttgart. 1959. Pp. xx+1057. DM60.

Karrer's well-known text-book of organic chemistry first appeared in 1928, and the first English edition (translated from the fifth German edition) in 1938. The reviewer's task concerning the new edition is lightened by the fact that here is a work which has now survived over 30 years, and, in the words of the familiar advertisement, is "still going strong" as is the author, who recently celebrated his 70th birthday.

The writing of a general text-book of organic chemistry presents, in modern times, difficult problems. The author is aware, from the beginning, that he cannot hope to cover anything approaching the whole field and yet keep the size and price of the work reasonable. This difficulty has been accentuated by the fantastic pace at which the subject has developed since the end of World War II. The writer must therefore be selective. Professor Karrer has indeed been selective, but has chosen his topics with such care that he has managed to include something of almost everything. There has been a particular emphasis towards the chemistry of natural products, as indeed we might have expected, being familiar with Professor Karrer's own distinguished contributions to that field; the author admitted this bias in his preface to the first edition.

Up-to-Date

A praiseworthy effort has been made to bring the subject matter really up to date. Modern subjects such as non-benzenoid aromatic compounds, conformational analysis, and biogenesis of natural products, are there, and in each particular chapter the latest developments have been included.

The book is divided into three parts, and each part into several sections. Part one deals with aliphatic compounds, including elementary analysis of organic compounds (the determination of phosphorous is missing), hydrocarbons, halides (here the discussion of fluorocarbons might perhaps have been a little longer), alcohols, esters, ethers, sulphur compounds, amines and other nitrogen-containing compounds, organo-metallic compounds, aldehydes and ketones, nitriles, carboxylic acids and derivatives, bifunctional compounds (including amino-acids, peptides and proteins), polyfunctional compounds (poly-alcohols, poly-carboxylic acids, carbohydrates, *etc.*) (406 pp.). Part two (403 pp.) is concerned with carbocyclic chemistry, and is sub-divided into aromatic and alicyclic compounds. The former section is an excellent account of the chemistry of benzene and its many derivatives; the latter includes terpenes and steroids, with some examples of non-benzenoid aromaticity (ferrocene, tropolones). The third part is devoted to heterocyclic compounds (143 pp.), and covers the chemistry of the usual 5- and 6-membered heterocyclic rings, followed by alkaloids (an excellent account, covering all the better-known natural bases). Finally, a few pages are devoted to biogenetic aspects of organic chemistry, and to a discussion of compounds containing isotopic elements (chiefly deuterium).

There are two tables (historical data, and constituents of coal tar), and author and subject indexes. References are chiefly to comprehensive works, with an occasional literature reference.

In his preface to the first English edition, Professor Karrer expresses the hope that the book will help the student in his studies. He need have no fears on that score concerning the new edition; the Honours student in particular will benefit from it, since it provides him with the basic information in a readable manner, and guides him to more detailed works for further study.

Errors are remarkably few and the binding is excellent, though the quality of the paper leaves a little to be desired. The price would seem to be very reasonable.

It is to be hoped that the authors and publishers are arranging for an English translation, for the work can be warmly recommended to the Honours Schools of British Universities.

A. R. PINDER.

Russian Chemical Journals in English

Newest of the Russian journals which the Chemical Society of London, in co-operation with the British Department of Scientific and Industrial Research, is translating into English is the *Russian Journal of Physical Chemistry*, commencing from the July 1959 issue.

Special precautions are taken by the translation team to eliminate obscurities inherent in such translations. Also available in English are the *Russian Journal of Inorganic Chemistry*, and the *Russian Chemical Review*. Publishers are the Cleaver-Hume Press Ltd., 31 Wright's Lane, Kensington, London

Nylon Developments on Show

First of its kind organised by British Nylon Spinners Ltd., 68 Knightsbridge, London S.W.1, is the convention to be held at Park Lane House, London, on 25 and 26 May, at which technical papers will be read and various articles of, or incorporating, nylon will be shown.

These range from a 100-ft. long Dracone to a miniature surgical suture, and will include several completely new developments not previously shown to the public.

Chemist's Bookshelf

Chemical Engineering Problems

CHEMICAL ENGINEERING CALCULATIONS. By *E. J. Henley* and *H. Beiber*. McGraw Hill Publishing Co., London, 1959. Pp. XI+441. 70s.

Often the first and most important step in a piece of chemical engineering analysis or design is the solution of the process material and energy balances, and a study of the methods and techniques of performing such balances is usually the student's first introduction to what may be termed chemical engineering proper. Problems of this type may be described simply as problems in the application of the first law of thermodynamics, although occasionally some aspects of the second law need to be considered. This over-simplification will mask only to the uninitiated the intricate, elegant and almost inexhaustible variations of techniques that may have to be applied to solve the balances on what might appear to be quite simple flow processes. Nevertheless, the most complex system can be handled quite readily.

The solution of problems of this type is not only a practical necessity but is also very excellent training for the student in applying simple scientific principles to what are to him new and unusual situations. This subject may be described as the back-bone of chemical engineering, in fact, and to the teacher it has the added utility of bringing to life the scientific subjects which the student has to master in the abstract and applying them directly to the sort of chemical engineering problems which he will be up against as a practicing engineer. There have been too few books up to the present time dealing with this important field, and so another work is to be welcomed, particularly one as scholarly as the present text.

Recognising that this is often the student's first introduction to chemical engineering, the authors begin with a brief review of the history of the subject. They then review the elements of stoichiometric calculations and proceed to outline the techniques of problem solving. Units and some elementary physical chemistry are dealt with in the next three chapters. Then, commencing in Chapter 7, material balances make their appearance, starting with the simplest case of those balances which involve no chemical reaction. These are solved first analytically and then graphically.

An excellent exposition of the meaning of thermodynamics in general and the first law in particular then follows and energy balances are dealt with. Finally, combined material and energy balances are considered.

At the end of the main text there are almost 100 pages of problems on which the student may practise the applied thermodynamics to be learned in the earlier sections of the book. This is followed by a helpful appendix on mathematical techniques, a derivation of the second law of thermodynamics and a useful set of physico-chemical data.

This is undoubtedly a very fine book, likely to become a standard work for many future students of chemical engineering and one which the practitioner could well find useful, not only to refresh his knowledge but to show him some new approaches.

D. C. FRESHWATER

Branched Chain Reactions and Thermal Ignition

SOME PROBLEMS OF CHEMICAL KINETICS AND REACTIVITY, Vol. 2. By *N. N. Semenov*. Translated by J. E. S. Bradley. Pergamon Press, London, 1959. Pp. X +168. 35s.

The first volume was mainly concerned with radical and radical chain reactions. The second, with different publishers and translator, deals with branched chain reactions and thermal ignition. It traces the development of these as fundamental concepts in combustion and explosion theory, develops their quantitative treatment and shows their importance in many reactions, including nuclear phenomena.

Following a brief introductory chapter in which the three basic cases of chain reactions are outlined, thermal ignition is discussed in detail in terms of the treatment of the author and his school. This is followed by an account of chain self-ignition in which chain branching is considered and the oxidation of phosphorus, sulphur and other substances discussed. The importance of chain ignition in the hydrogen-oxygen reaction is then considered and the occurance of upper and lower pressure limits explained. A further chapter deals with cases in which reaction chains may interact with resulting loss or branching of chains. The last chapter deals with degenerately branched chains in which the main chain is unbranched but some product decomposes or reacts to give free radicals which initiate new chains. It includes an account of hydroperoxide and aldehyde formation and some new phenomena in hydrocarbon and aldehyde reactions.

Each chapter is well provided with references and the contributions of different schools are shown. The book concludes with 18 pages of errata and addenda to volume 1. The subject index is hardly adequate; printing and binding are an improvement on those of the first volume. The book is very readable and, like the first, contains a wealth of information and data of great value to the technologist concerned with explosion, combustion and reaction kinetics.

W. R. MOORE

Chemistry of Nitrogen, Non-metallic and Organometallic Compounds

'LEHRBUCH DER ORGANISCHEN CHEMIE', Vol. 1, 2nd. half, 2nd. Edn. By *Friedrich Klages*. Walter D. Gruyter and Co., Berlin, 1959. Pp. XVI+521. DM. 66

The work of which this book forms a part began to appear in 1952, and extends into three volumes. The part reviewed is the second half of Volume I of a new and revised edition.

This particular part contains seven chapters, grouped under the title of 'Nitrogen and other non-metallic compounds, organometallic compounds, and cyclic compounds'. The first chapter is devoted to the organic chemistry of nitrogen, and covers the familiar aspects of this subject (amines, diazo-compounds, hydroxylamines, hydrazines, etc., nitro- and nitroso-compounds). Then follows a similar treatment of organic sulphur compounds, and of organic derivatives of selenium, tellurium, phosphorus, arsenic, antimony, silicon, germanium, and boron. Organometallic compounds, including those of the alkali metals, magnesium, zinc, cadmium, aluminium, gallium, indium, mercury, tin, and bismuth come next.

A chapter entitled 'Compounds with anomalous functions' deals with compounds such as carbon monoxide, *iso*-nitriles, fulminic acid, free radicals, and compounds containing isotopic elements (deuterium, 'heavy' oxygen, nitrogen, carbon, and radioactive elements). The penultimate chapter is a long one giving a concise account of the chemistry of cyclic compounds, ranging from *cyclo*-paraffins to polycyclic benzenoid compounds, pyridine, quinoline, *iso*quinoline, acridine, and phenanthridine, diazines, triazines, tetrazines, pyrones, and pyrylium salts, and compounds derived from pyrrole, furan, and thiophene. Finally there is a most useful chapter on degradation and synthesis in organic chemistry. There are author and subject indices, and a collective subject index for volumes I, II, III.

The main function of this work is to provide a source of the latest information on the various topics included. It will be of great value to the advanced student and in particular to the research worker, who wants to know about recent trends in subjects of his interest. All the references cited are post-war, some being as late as 1958, and, as stated in the preface, only the more important ones are given. There is no shortcoming, for many of the references are to review articles, which themselves provide copious sources of additional references.

Lest the impression be given that it is solely a reference book, it should be stated that the extensive information is presented in a readable style, with copious formulae, arranged in many cases chart-wise, which makes for speedier assimilation of the facts. The reviewer liked particularly the last chapter, on degradation and synthesis with its systematic account of hundreds of reactions used for breaking down and building up organic compounds.

A. R. PINDER

I.C.I.'s Paint Division Uses G.L.C. for Research

GAS chromatography has been found particularly useful for the analysis of complex mixtures of solvents which are constantly in use, I.C.I. Paints Division record in *Finishing Facts* for January. Such analysis can be completed in a small fraction of time and with quantities with which separation by distillation would be impracticable.

Paints Division is using the technique also for analysing plasticisers used in paint manufacture, to check the purity of materials received from outside suppliers, to investigate the drying properties of lacquer-type films, and in a modified form to assess the fineness of pigments employed in a wide range of industrial finishing materials.

Uses of Zirconium and its Alloys

IN an attractively presented new booklet 'Wrought zirconium' the Metals Division of I.C.I. have provided a *résumé* of the uses of zirconium and zirconium alloys in industry. The metal has become very important in nuclear engineering, providing low neutron absorption, high mechanical strength and corrosion resistance.

I.C.I. Metals Division is primarily concerned with production of wrought zirconium, but also manufacture fabricated components, either directly or through sub-contractors, with I.C.I. inspection. A clean area conforming to U.K.A.E.A. standards has been established at Witton for the handling of such products.

Battery Symposium

Twenty-five papers, covering a wide field of subjects concerned with research, development and application of battery systems, are planned for the 1960 Battery Symposium to be held at The Pavilion, Bournemouth, from 18 to 20 October. Organised by the I.D.C.B. it follows a similar successful venture in 1958.

Obituary

Mr. Victor Blagden, past president of the British Chemical and Dyestuffs Traders' Association, died on 31 March after a brief illness. He was 92 years old. Mr. Blagden was the first chairman of the association, and for 27 years its president, an office he relinquished in 1949. In the same year he retired from the board of Victor Blagden and Co. Ltd., of which he was chairman and founder. CHEMICAL AGE featured a 92nd birthday tribute to Mr. Blagden in the issue of 6 June 1959.

Doyen of chemical merchants, Mr. Blagden was mainly responsible for the formation of the British Chemical and Dyestuffs Traders' Association in 1923. No man was more highly regarded in the industry and he was held in esteem for his business ability and affection for his personal qualities. A memorial service will be held at St. Peter's Church, Vere Street, London, W.1, on Monday, 11 April at 2 p.m.

DEVELOPMENTS IN DEIONISATION TECHNIQUES DESCRIBED

SOME of the latest developments in the deionisation of water were described by Dr. L. Saunders, D.Sc., Ph.D., F.R.I.C., School of Pharmacy, London University, at a conference arranged by Elgar Products Ltd., Lane End, Buckinghamshire, in London last week.

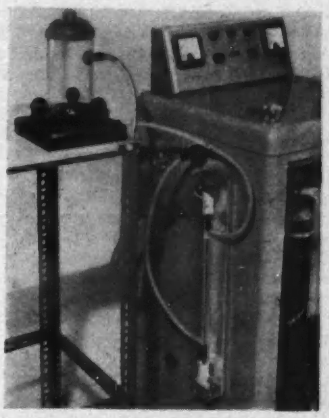
Deionised water has displaced distilled water in research and teaching, in laboratory and manufacture, said Dr. Saunders, and much academic research and industrial developments could not have taken place without it. Eight distillations in a quartz still were required to produce water of 10 megohm-cm. electrical resistivity, and water of that order was needed in vast volumes for transistor manufacture. To produce it by distillation would be technically and economically impossible.

Mixed-bed deionisation, however, could produce an effluent of 16 megohm-cm. resistivity instantly and at high flow rates. Production costs were low. In field research a small unit, weighing 25 lb. could take the place of a distillation plant more than 20 times greater in weight and volume.

Three pieces of equipment were described at the conference. The Elgastat producing intrinsic water for transistor washing, has a u.v. radiation unit between the deionisation column and the effluent point as an additional sterilant. Not only are all dissolved ions removed, but also bacteria, viruses and undissolved solids.

The use of the Elgastat for removal of radioactivity from water was also described. A radiation counter gives a visual test of decontamination, contact being made through a surface probe.

A portable deioniser, measuring 28 in. by 18 in by 10 in, has two functions. It is designed for use by the Services in



The Elgastat with a u.v. radiation unit fitted between the deionisation column and the effluent point

field medicine and surgery, mobile laboratories, field research and in mobile pharmacies. In addition it can be utilised as an emergency unit for the purification of drinking water in areas where radioactive contamination is suspected.

A new mobile exhibition is available to academic and industrial laboratories.

600 Attend C.S. and R.I.C. Joint Annual Meeting at Belfast

ABOUT 600 members and their wives attended the joint annual meeting of the Chemical Society and Royal Institute of Chemistry, held in Belfast this week. On Tuesday they were entertained at a reception and dance in the City Hall by the Lord Mayor.

At the R.I.C. annual meeting on Wednesday the following were elected: vice-presidents, Professor H. J. Emeléus, C.B.E., F.R.S. (professor of inorganic chemistry, Cambridge and president C.S., 1958-60); Professor R. A. Morton (professor of biochemistry, Liverpool and chairman, Biochemical Society); and Dr. G. R. Ramage (head, department of chemistry, Royal Technical College, Salford). Hon. treasurer, Professor H. Burton (professor of chemistry, Queen Elizabeth College).

Elected to the council were: Dr. H. J. Barber (May and Baker); Dr. R. W. Bolland (Bristol College of Science and Technology); Professor W. Bradley (Leeds University); Dr. C. M. Cawley, C.B.E. (chief scientist, Ministry of Power); Mr. J. E. Davis (South-Eastern Gas Board); Dr. C. Forrester (Ministry of Power); Professor L. Young (professor of biochemistry, London University).

The annual meeting was followed by the presidential address, entitled 'Chemistry, industry and society' given by Mr. E. Le Q. Herbert, president, who remains in office until 1961. His address was illustrated by film, some of which was produced specially for the occasion.

Annual meeting of the Chemical Society was held on Thursday.

Standardisation for Pipe Hangers Proposed

The Engineering Equipment Users' Association has recently studied problems relating to lack of a British Standard for pipe hangers, used extensively by industry. The association has submitted a document to the B.S.I. to be used as a basis for dimensional standardisation.

Foundry Process Filmed

A 16 mm. sound and colour film produced by the Distillers Co. Ltd., Chemical Division, carbon dioxide department, Devonshire House, Piccadilly, London W.1, shows the operation of the CO_2/silicate process for hardening foundry sands. Running time is 16 minutes.

Vapour Deposition Process Produces Tungsten for High-Temperature Coatings

TUNGSTEN—one of the few metals that possess any structural strength at temperatures above 2,000°C—can now be easily plated on metal surfaces, reports the U.S. National Bureau of Standards, using a vapour deposition process developed for the U.S. Navy. A similar method has been developed independently by the U.S. Bureau of Mines.

The process, devised by W. E. Reid and Dr. A. Brenner of the Bureau, involves reducing gaseous tungsten hexafluoride with hydrogen by passing it over the heated object to be plated. At temperatures above 300°C tungsten is deposited on the hot surface, and the only other reaction product, hydrogen fluoride, passes out with the excess of hydrogen.

The very high melting point (3,140°C) of tungsten, its hardness and its corrosion resistance make it a desirable material for high-temperature equipment. Its high-temperature properties could not be effectively utilised, however, since its brittleness and hardness prevented it from being machined by conventional methods while its weight has restricted its uses in aeronautical equipment. Hence the need to develop a practical method for depositing tungsten coatings. The new process makes it possible to coat numerous simple and complex surfaces such as rocket and missile nozzles and jet engine parts. The technique also lends itself to the fabrication of tungsten articles and may be the only way that complicated shapes of tungsten can be formed. Simple tungsten shapes for use in vacuum tubes have already been fabricated.

Fused Electrolyte Process

Deposition from both fused electrolytes and the gaseous phase has been evaluated. In the fused electrolyte processes, however, the rate of plating was too slow, the deposit was too rough, and the coatings could not be built up to the desired thickness.

Tungsten hexafluoride was selected for use in the vapour deposition process for two reasons. Firstly, the compound is a gas at room temperature and therefore convenient to use. Secondly, tungsten apparently forms only one compound with fluorine—WF_6, so that the reactions are straightforward and uncomplicated by many products or side reactions.

Equipment required is simple. The object to be plated is placed inside a cylinder of ceramic material and then air is pumped out and replaced by hydrogen. A controlled temperature induction furnace heats this object to about 650°C. The two gases, tungsten hexafluoride and hydrogen, are passed through ordinary glass flowmeters into the reaction chamber, and when this gaseous mixture comes in contact with the heated object, tungsten is deposited on the hot surface. The by-product, hydrogen fluoride, is absorbed in a suitable trap.

Although the theoretical ratio of three moles of hydrogen to one mole of hexafluoride is needed for complete reduction, satisfactory coatings can be obtained when the ratio is lower. In practice, however, smooth deposits are ensured by using a hydrogen-to-hexafluoride ratio greater than 6. Optimum temperature range for rapid formation of smooth deposits is 650 to 700°C, but temperatures in the range from 300°C to nearly 900°C are reported to be "fairly effective". Definite crystal growth is observed at 900°C when the ratio of hydrogen to hexafluoride is 3 to 4.

Spectrochemical examination shows that tungsten obtained by vapour deposition is purer than ordinary commercial tungsten. The only impurity noted to be present in a concentration of 0.1% or more is silicon. The deposited metal has the theoretical density of pure tungsten—19.3 g/cm³, which is higher than that of tungsten compacts produced by powder metallurgy, or by flame spraying, plating eliminating the very tiny holes between tungsten particles resulting from the other two processes.

Investigation of the adhesive bond between the tungsten coating and various basic materials has shown that adhesion to molybdenum and to nickel is good; to copper, somewhat weaker; and to iron, rather poor. The tungsten-graphite bond was about as strong as the graphite itself. Tungsten deposited on ceramics has also shown good bonding.

Deposits 1/16 in. thick have been obtained by vapour deposition in an hour. This compares with 0.001 in. deposits obtained in the same time from fused salt melts in electrodeposition. The maximum thickness of deposit that can be obtained has not yet been determined.

Plating a metal strip or wire is reported to be simple, but uniform distribution of tungsten over an irregularly shaped object is a problem that has to be solved for each item. It has been found that deposition is more uniform over the exterior of an object if plating is carried out in a chamber much larger than the object. As it has been noted that tungsten deposition occurs in greatest quantity where the gases first strike the hot object, it is suggested that better distribution will probably be obtained by passing hydrogen through the main opening in the chamber and leading the WF_6 to various parts of the object, by a system of injector tubes.

Combining Refractory Metals with Graphite for H.T. Resistance

COMBINING refractory metals with graphite is believed likely to provide an answer to the need for high-temperature resistant materials. A report in the U.S. (*Chem. Engng.* 1959, **66**, No. 26, 24) indicates that at least four companies have revealed details of new or improved techniques.

Working with American Metal Products, Falls Industries are experimenting with the impregnation of graphite with titanium vapour. The company say that the material obtained maintains heat-transfer properties of graphite, and has temperature resistance upwards of 2,000° F while having the corrosion resistance against nitric acid, sulphuric acid and hot wet chlorine of titanium.

This development is reported to be a direct follow up of such established materials as silicon-carbide-impregnated graphite and furane, epoxy and phenolic resin-impregnated graphite (for example, karkate, Impervite). Although more expensive than these, titanium graphite has a much greater potential for high temperature service.

The titanium impregnation of graphite components such as rocket nozzles and heat exchangers fabricated by Falls Industries is carried out by American Metal Products. Titanium vapour is injected into a vacuum furnace containing heated graphite parts. The metal penetrates the surface and reacts with the graphite to form titanium carbide. The process can be controlled to give a thin titanium carbide level or can be carried to the point where the whole graphite piece takes on the appearance of titanium.

Metallizing Engineering Co., which offers commercial plasine-spray equipment say that they have developed a new unit that can spray-coat titanium directly on a completely unprepared graphite surface. Linde Co. report also that they have developed means of applying tungsten directly to graphite with their plasma arc torch with the use of expensive undercoatings such as rhenium. The material produced, Linde claims, withstands flame temperatures around 5,500° F and pressures of 500-1,000 p.s.i.

New Tungsten-Molybdenum Separation Process

FOR selectively extracting tungsten and molybdenum from domestic mineral concentrates, the Bureau of Mines have developed a fused salt-bath electrolysis process. Of considerable industrial interest, this new process promises to reduce costs of producing acceptable-grade tungsten and molybdenum-metal powders from scheelite concentrates containing both metals. Only a one-step operation is required.

The Bureau's report, written by J. B. Zadra and J. M. Comes, metallurgists at the Bureau's Reno (Nev.) Metallurgy Research Centre, covers laboratory work and bench-scale experiments. It is published as Report 5554, Electrowinning Tungsten and Associated Molybdenum from Scheelite, Bureau of Mines, Publications-Distribution Section, 4800 Forbes Avenue, Pittsburgh 13, Pa.

Overseas News

ETHYLENE DICHLORIDE TO BE PRODUCED BY COLUMBIA-SOUTHERN USING OWN CHLORINE

CUSTOMER for their own chlorine this autumn will be Columbia-Southern Chemical, when their ethylene dichloride (EDC) plant at Lake Charles, La., will be completed. Built at a cost of over $1 million the plant is scheduled to be on stream in September. It is adjacent to Columbia's large chlorine/caustic soda plant. Ethylene for the EDC unit will be piped from Petroleum Chemicals Inc., plant three miles away.

No capacity figure has been revealed for Columbia's EDC plant, but estimates suggest it will range up to 100 million lb. a year. This would require some 45,000 tons of the company's total chlorine capacity of 1,750 tons a day at four plants. U.S. EDC capacity would thus be raised to some 900 million lb. a year. The new plant will use the process developed by the company's research and development department, Corpus Christi, Texas, where pilot plant scale testing has been carried out.

Columbia-Southern have no plans to use the EDC produced, it is reported, although it is understood they have expressed an interest in methyl chloroform potentialities.

Pennsalt to Treble Output of Alkyl Alkanol Amines

Pennsalt Chemicals have started construction of a new alkyl alkanol amines plant at Wyanadotte, U.S. It will treble the company's production of this material and is designed to use a continuous process to manufacture six or seven different alkyl alkanol amine products from amines and ethylene oxide. Due on stream at the end of the year, the plant is expected to take up expanding demand and "promising prospects for many new uses" for the next three to five years.

Expansion of Italian Maleic Anhydride Plants

Bombrini Parodi Delfino are expanding the capacity of their maleic anhydride plant which they operate at Colleferro to 3,000 tons a year, and plan a further increase next year.

Ftalital of Milan are to expand the capacity of their maleic plant from 1,500 to 10,000 tons a year. To achieve this, an additional 3,500-tons a year plant will be added late in 1960 and another with an output of 5,000 tons is scheduled on stream early in 1961.

Germany Produces Less Ammonia, More Phthalic and Methanol

The cutting of production in West Germany's coking plants last year led to a reduction in the output of primary by-products. Crude benzole production sank by 10.7% on 1958 figures to 495,000 (548,000) tonnes, while output of ammonia fell by 7.4% from 108,000 tonnes to 100,000 tonnes, that of crude tar by 9.1% from 1,900,000 to 1,730,000 tonnes and that of gas by 8.9% from 22,500 million to 20,500 million cm.

Production of some of the coal chemicals increased and output of methanol rose by 18½% to 296,600 (250,300) tonnes and that of phthalic anhydride by 21% from 46,200 to 55,900 tonnes. Prices for methanol products fell despite increased demand, as did those of tar products. Naphthalene and pure pyridine were in short supply. Exports by German producers rose in the case of coumarone resins, cresol and phenol. Total carbon black production equalled virtually total capacity, and further production units for furnace carbon black are in construction.

Soviet Chemical Exports to Federal Germany

An agreement fixing the export quotas between Russia and West Germany for the current year contains the following contingents (1959 quotas in brackets): basic oils, 15,000 tonnes (same); chemical products, worth of DM3 million (DM6 million); benzole, 25,000 (20,000) tonnes; pharmaceuticals and raw drugs, worth DM900,000 (DM500,000); mineral oil, 1,500,000 (700,00) tonnes.

U.S. Companies Interest in Fluorocarbon Plastics

General Chemical, a division of Allied Chemical, U.S., are to produce a new group of fluorocarbon plastics at Baton Rouge, La, where a plant is to be built. First product will be a non-inflammable thermoplastic resin based on chlorotrifluoroethylene.

Now available in pilot plant quantities from Pennsalt Chemicals is a new fluorocarbon plastic-polyvinylidene fluoride resin. Du Pont and Minnesota Mining are also interested in the fluorocarbon plastics field.

To cope with the fluorine demand, General Chemical are planning to expand their hydrofluoric acid capacity at Nitro West Virginia by 50% to over 10,000 tons a year. The company has recently acquired for its fluorine interests new fluospar reserves of more than 1 million tons near San Louis Potosi, Mexico.

Polyurethane-base Coating will Resist Heat to 6000°F

A new heat-resistant plastics coating, Dyna-Therm D-65, has been developed by Dyna-Therm Chemical Co., Culver City, Calif, to protect missile launching pads and various components usually destroyed in missile firing. Said to have proved effective in field tests at temperatures as high as 6,000°F, it is a mixture of flameproofing agents—phosphates and boron chemicals—with a polyurethane binder.

On heating the binder 'softens' and allows the exposed surface to move away from the substrate. The exposed surface forms a hard ceramic-like crust which becomes red hot, glows visibly and reflects heat. Because of the coating's ability to foam and swell when exposed to flame, the crust lifts away from the remainder of the D-65 film. This process is repeated until it works down through all the protective layers of the substrate.

Protection varies with coating thickness. D-65 is a liquid with about 30% solids and can be applied by spraying or brushing. Present production is about 500 to 1,000 gall. a month; expansion plans are in hand.

Plans for Two Lube Oil Refineries in Australia

Plans for two lubricating oil refineries in Australia have reached an advanced stage. Work is expected to start almost immediately on a site near Sydney for a joint venture between Caltex, Ampol Petroleum and H. C. Sleigh. The other project, planned by BP (Australia), is for a plant costing between £A8 million and £A10 million, with a capacity of up to 100,000 tons.

Polystyrene and Fertilisers in Greek Chemical Schemes

A number of chemical projects planned to expand the Greek industrial economy are referred to in a report issued by the country's official information channels. The Dow Chemical Co., of the U.S., is stated to be preparing for co-operation with a Greek concern in production of polystyrene in Greece, while production of both synthetic fibres and superphosphate fertilisers is planned with American capital to finance the fertiliser project. The Greek Bureau for Industrial Development is at present bringing to the attention of all foreign bodies interested, the facilities for the future production in Greece of quantities of plastics based materials and calcium carbide.

Austrian Chemical Plans

The Donau-Chemie concern of Austria are planning erection of a large chemical plant at Moosbierbaum. Incorporated in the works will be the refinery at present operated by the O.M.V. company which is being taken over by Donau-Chemie at the end of this year when its present owners cease to operate it. Further details of the plant are expected later.

Electrolytic Ti Production in low Temperature Salt Bath

Practical production of titanium electrolytically in a low temperature salt bath is believed to be more than a possibility by two Canadian researchers, Drs. Spyridon N. Flengas and Thomas R. Ingraham, Department of Mines and Technical Surveys, Ottawa. They have found that titanium tetrachloride dis-

solves in molten salts containing KCl.

A KCl-NaCl entectic containing 14% titanium at 690°C has been prepared as a result, it is considered, of K_2TiCl_6 in the melt. This compound begins to decompose at about 300°C and hence high temperature melts such as KCl-NaCl do not favour solubility of $TiCl_4$. A low-temperature melt such as KCl-LiCl could lead to operation of electrolytic cells at temperatures where the intermediate is stable, the mixture melting at about 250°C. One problem involved is the oxidation by air of lithium chloride to the oxide, so if the oxide can be simply converted back to the chloride, low temperature baths would be practical for an electrolytic process. Also as the discharge potential for Ti ions is less than 2 volts, and for Na ions, 3.4, in a cell with a controlled potential it is thought possible to deposit titanium with discharge of Na or K ions.

Propylene Oxide Plant for Construction in Sicily

Plans for construction of a new production plant for propylene oxide and derivatives, at Priolo, Sicily, are in hand by S.p.A. Celene, a company formed in 1957 and jointly owned by Union Carbide Corporation and Societa Edison. The new plant will have an initial capacity of 25 million lb. annually, and several chemical derivatives manufactured will go to the plastics and automotive markets. Basic raw material will be obtained from the nearby plant of Sincat.

Celene's initial polythene plant is now on stream and being expanded to annual capacity of some 65 million lb. The company have also under construction at Piolo facilities for production of solvents and plasticisers, with 70 million lb./year capacity.

Pipeline to Carry Natural Gas to the U.S.

Immediate construction of a 30 in. pipeline is proposed, to carry Alberta natural gas from Winnipeg, Canada, to the U.S. border at Emerson. The new 50-mile-long feeder, to cost some £11,850,000, will branch from the existing line which runs from Alberta to Montreal, and will be constructed in 90 days after the granting of the licence. Decision to permit the export was made by the Federal Canadian Government, and the franchise for gas distribution from Alberta is held by Trans-Canada Pipelines Ltd. From the project gas will flow to Fargo, North Dakota, Minneapolis and St. Paul in Minnesota, and to other communities in the U.S. middle west.

New Catalytic Reformer Will be Japan's Largest

Construction of a 6,000 barrels per day Houdriformer catalytic reforming unit and an 8,000 b/d hydro-desulphurisation unit by the Nippon Mining Co., Ltd., at Mizushima, Japan, has been licensed by Houdry Process Corporation of Philadelphia. The Houdriformer will process 6,000 b/d. of desulphurised petroleum naphtha, with the remaining output of the desulphuriser being used for jet fuel blending and speciality naphthas. The plant will be the largest catalytic reformer in Japan and completion of the two units is planned for mid-1961. The catalysts will be supplied by Houdry.

U.S. Petrochemical Venture

A petrochemical plant to be opened next year is to be erected in Los Angeles by the newly-formed U.S. concern Witfield Chemical Corporation, a joint subsidiary of the Witco Chemical Co. Inc. and the Richfield Oil Corporation. Initial cost of the plant is given as $1,750,000.

Huls Lay New Natural Gas Pipeline

A second direct pipeline some 53 miles in length is at present being laid from Bentheim, in the West German natural gas fields of Emsland, to the Marl works of the West German chemical producer Chemische Werke Hüls, AG. The line, which will cost almost £1 million, will have a daily capacity of 2 million cu. m. of methane gas. At the same time new gas borings are to be made in the Bentheim area and production raised. Most of the gas produced there is destined for the chemical industry.

Reichhold Link Formed with Hercules Powder Co.

Reichhold Chemical Industries (Australia) Ltd. have joined Hercules Powder Co., U.S., in an Australian venture. The two companies will form Hercules Powder Co. (Aust) Pty Ltd., to manufacture resin derivatives and other industrial chemicals for sale in Australia and New Zealand.

Reichhold's part in the venture will be taken by A. C. Hatrick Pty Ltd., a wholly owned subsidiary, who have represented Hercules for 30 years. Reichhold, an offshoot of Reichhold Chemicals Inc., U.S., the world's largest producer of synthetic resins, have expanded rapidly in the last 12 months by takeover. They acquired J. W. and T. A. Smith (Aust) Pty Ltd., last December to form a new subsidiary Smith Reichhold Colours (Aus) Pty Ltd.

Reichhold also purchased Frank G. Spurway (Holdings) Ltd., an electrical engineering firm in a £1 million diversification move in December. Star Machinery Pty was added to the group in March. The new Hercules company will be based at Springvale, Melbourne, where Reichhold opened a resin plant in 1957.

South Africans Sell Carbide Plant

Shareholders of the South African Carbide and By-Products Co. Ltd. have agreed to the sale by the concern of a carbide plant to the Holland Electro Chemical Industries (Pty) Ltd., of Johannesburg. The Holland concern is a subsidiary of the Amsterdam chemical producer N.V. Electro Zuur-en Waterstoffabriek. Total price is given as £183,061, £100,000 of which is for the site.

Pakistan Wants German Chemical Aid

Chemical products, including synthetic fibres and plastics, headed the list of items in which West Germany was invited to invest in Pakistan, according to an announcement by the country's Minister for Industry last week. It was stressed that German Government guarantees for investments were to be recognised by the Pakistani authorities, that legal and fiscal facilities were particularly advantageous in the country, and that there was no condition that local capital or labour had to be used in such investments.

Acetylene Expansion for Diamond Alkali

CONSTRUCTION of an acetylene plant by Diamond Alkali is expected to begin this autumn with acetylene being on stream by late 1962. Engineering and design are complete; only final board approval is required. The process to be used will involve partial oxidation of natural gas and will be carried out at Diamond's Deer Park complex at Houston, Texas.

Behind this expansion plan for acetylene is the fast growing polyvinyl chloride market in the U.S. For some time the company has been buying acetylene but requirements now are such that they would support their own production. Diamond are also interested in an acetylene-based propellant. Other major projects include: additional p.v.c. resin capacity; facilities for more vinyl chloride monomer and additional chlorine capacity.

"Internally generated funds," it is hoped, will pay for this proposed capital expansion programme, estimated to cost $30 to $35 million. Key to the expansion is to be "successful interlocking" of processes. Thus by-product hydrogen chloride from chlorination of organics will be reacted with acetylene to give vinyl monomer.

As a result of intensive new product research, now receiving a major portion of the company's $4 million-a-year research budget, new uses for chlorinated xylenes have been found, i.e. Dacthal, an active ingredient in Rid crab-grass weed killer. The company also plan additions to their chlorinated organics range and will broaden their plastics business. Now limited to p.v.c. production, Diamond will add at least one new basic plastics material and several speciality resins to their range.

In the alkali field, Diamond are investigating shipping costs to see if soda ash obtained from trona (sodium sesquicarbonate) could be shipped to eastern U.S. markets. Rising prices generally are foreseen in basic inorganic chemicals, such as caustic and chlorine, as a result of rising costs. The company raised chlorine prices by $2 a ton this month.

PEOPLE in the news

● **Mr. P. J. Ward** has been appointed new plastics and rubber sales manager in the Midland sales region of Shell Chemical Co., Birmingham, from 4 April. He succeeds **Mr. S. Slaney** who has taken charge of the sales promotion activities of the Plastics Division in London. Mr. Ward joined the company as a technical sales representative in June 1959, having previously been technical sales manager of T.I. Plastics Ltd. and Mange Plastics Ltd.

● **Mr. E. E. Clayton** has joined the board of Beecham Overseas Ltd. as director and secretary and **Mr. F. S. Lomax** has become export director of Beecham Research Laboratories Ltd. The latter was, until recently, managing director of the group's subsidiary in Dublin. Another group appointment is that of **Mr. K. A. B. Moore** to the board of Beecham Pharmaceuticals as administrative director.

● **Mr. J. D. Cockcroft** has been elected to the board of Reckitt and Colman Holdings Ltd.

● Formerly deputy chairman of United Glass Ltd., **Mr. E. A. S. Alexander** has relinquished that post and also his executive duties.

● **Dr. J. C. Hudson,** head of B.I.S.R.A's corrosion section, has been awarded the Sir Robert Hadfield bronze medal by the Iron and Steel Institute for distinguished service in the development of the science of ferrous metallurgy.

● Recently appointed lecturer in chemistry at the University of Southampton is **Dr. I. D. R. Stevens.**

● **Dr. R. L. P. Berry,** beryllium project manager since 1958, has been appointed to the board of I.C.I. metals division. He joined the research department of the division in 1936. Dr. Berry has been primarily concerned with the development of 'new' metals, notably titanium and beryllium, and in 1958 was appointed project manager in charge of the construction and commissioning of the I.C.I. beryllium plant.

Dr. Berry

Dr. Berry, who is 41, has also been appointed to the delegate boards of two I.C.I. subsidiary companies, Marston Excelsior Ltd. and Lightning Fasteners Ltd.

● **Mr. C. A. F. Hastilow, C.B.E., M.Sc.,** chairman of Dockers Brothers, Birmingham, and a director of Smith and Nephew Associated Companies Ltd., is among the members of the Industrial Estates Management Corporations for England, Scotland and Wales, which have been set up under the Local Employment Act which came into operation on 1 April.

● **Mr. Ivon A. Bailey** has been appointed deputy chairman of the Mond Nickel Co. Ltd. and of Henry Wiggin and Co. Ltd. **Mr. Edward Vaughan** has been appointed a director of both companies.

N. F. Patterson

● **Mr. N. F. Patterson, O.B.E., T.D.,** director in charge of engineering and purchase, Monsanto Chemicals Ltd., has now assumed the duties of personnel director of the company in succession to **Sir William Garrett, M.B.E., B.Sc., Ph.D.** Sir William, who held the post among his other activities in the company, has relinquished his executive responsibilities with Monsanto to devote more time to his own interests, but will continue as a member of the board. He is chairman of the Association of British Chemical Manufacturers.

● Officers elected for the committee of the Agriculture Group, the Society of Chemical Industry, for the 1960/61 session are: chairman, **Dr. A. H. Cornfield,** London University; vice-chairman, **Dr. H. I. Richardson,** I.C.I.; hon. treasurer, **Dr. J. H. Hamence,** Dr. Bernard Dyer and Partners; hon. secretary, **Dr. I. D. Morton,** Unilever Ltd., Colworth House, Sharnbrook, Bedford; hon. assistant secretary, **Dr. P. W. Arnold,** Rothamsted Experimental Station, Harpenden, Herts; hon. recorder, **F. D. Cooke,** Leonard Hill Ltd.

● Contract adviser to The Distillers Company Ltd., and director of subsidiary companies, **Mr. G. F. Ashford** has been appointed deputy chairman of the Chemical Group as from 1 April. He joined the legal department of the company as a solicitor in 1937 and returned in 1945, after war service, to become legal advisor on the industrial side. Other changes in the division include the retirement of the managing director, **Mr. J. M. Rimington,** who will be succeeded by **Mr. J. H. Dunn.** Mr. Dunn's place as assistant managing director (commercial) of the division will be taken by **Mr. J. S. Hunter.**

● New controller of personnel of Monsanto Chemicals Ltd. is **Mr. S. E. Chaloner** who, for the past 12 years, has been chief personnel officer. He joined the company 35 years ago and has had experience of research, production and personnel management at factory level. A graduate of Manchester University, he is an executive member of the Association of Chemical and Allied Employers, a governor of Hendon Technical College and a member of the Institute of Personnel Management.

● **Dr. A. J. P. Martin** has relinquished his position as a director of Griffin and George (Research and Development) Ltd., so that he can concentrate primarily on fundamental research work. The company will retain his services as a consultant and he is succeeded as director of research by **Mr. R. C. Palmer, M.A.(Cantab),** his present deputy. Mr. Palmer was on the staff of the Wool Industries Research Association, Leeds, from 1937 to 1951, when he was appointed director of research of the South African Wool Industrial Research Institute.

● **Mr. E. A. Wright, F.P.S.,** has joined K.W. Chemicals Ltd. as from 1 April.

● **Mr. K. B. Sandiford, B.Sc.,** has joined Hagan Controls Ltd., a company associated with The Plessey Co. Ltd., Ilford, Essex, as general manager. Hagan Control's activities, it is reported, will embrace the "whole field of automatic control."

● **Mr. Curtis M. Klaerner** has been appointed a director of the Mobil Oil Co. in place of Mr. Arthur L. Lanckton, who has resigned.

● **Mr. D. M. Boyd,** who has been a director of Fisons Limited for the past 18 years, retired from the board on 31 March 1960. He will remain with the company for a further year to complete his work with the Association of Chemical and Allied Employers, of which he is chairman.

● **Mr. C. P. Percy,** chairman and managing director of J. M. Steele and Co. Ltd., London, has retired from his executive post after 45 years' service, but will for the time being retain his seat on the board as chairman. **Mr. A. G. Ballard** and **Mr. H. R. Peters** have been appointed joint managing directors, and **Mr. J. V. Webb** becomes secretary of the company.

● **Mr. P. Weston-Webb** has been appointed managing director of Chem-

(Continued on page 619)

Commercial News

- **Anchor Chemical Sales Reach £6 million**
- **Glaxo Report 30% Trading Profit Rise**
- **Unilever–Egyptian Agreement on Syndets**
- **Du Pont of Canada's Sales Higher by 11%**

Anchor Chemical

Sales of the products of Anchor Chemical Co. Ltd. throughout the year reached the record figure of over £6 million, according to a statement issued by the chairman, Mr. Thomas Martin, on the occasion of the company's 53rd annual general meeting.

The company are experiencing competition from new carbon black production units in many countries, but sales have been maintained. Sales of the high-impact thermoplastic ABS resin have increased, as have those of curing agents for synthetic resins (more than 50% up), and overall annual tonnage continues to rise. Export sales "have increased by a large margin".

Bakelite Ltd.

Newer thermoplastics materials production by Bakelite Ltd. showed a marked increase in 1959, states the annual report. The position in the polythene field was further improved. Some setback was experienced in sales of polyester resins due to domestic and world-wide shortage of a basic raw material, but already there are signs of improvement in the group's position. It is hoped that the raw material problem will be solved in the coming months.

Baker Perkins Ltd.

Group profits before tax of Baker Perkins Ltd. amounted to £771,526 (£893,972) after depreciation of £311,671 (£287,002) and reserve allocation £47,929 (£92,196). The 1958 figure includes £115,714 profit on sales of assets.

Trading results of the parent and U.K. subsidiaries were reported somewhat lower, owing to slowness of capital equipment orders following the recent recession.

Glaxo Laboratories

A 30% increase in trading profit is announced by Glaxo Laboratories for the interim period of six months to 31 December. A 7% dividend is to be paid (5%): the trading profit for the six month period of £3,181,000 compares with £2,418,000 for the same period of the previous year.

Blythe Colour Works

Consolidated net profit of the Blythe Colour Works Ltd. rose for the year ended 31 December 1959 by some £47,000, to a total of £294,976, as described in a statement by the chairman, Mr. D. R. Wildblood.

Building operations at the Creswell factory have continued throughout the year, and still further extensions are required, the report states. Plans are also under consideration to increase production at the Australian subsidiary "in order to relieve pressure on this small but efficient plant".

At the same time, the directors are "constantly watching for opportunities to widen the basis" of operations by developing new products which may arise from the research programme. It is also hoped to develop a service on lines of mutual interest with the company's consumer industries.

Reckitt and Colman

The business of D. R. Collins Co. Ltd., proprietors of Goya and other perfumery and toilet brands, has been acquired by the Reckitt and Colman Holdings Group.

Unilever Group

Sales of soaps and detergents by the combined Unilever Ltd. and Unilever N.V. rose from 1,740,000 to 1,787,000 tons last year. In the U.K. Persil retrieved all the tonnage lost in 1958, while synthetics Omo and Surf had a good year.

Expenditure on fixed assets amounted to £41.2 million (£40.3 million), and estimates for such expenditure are higher for 1960.

In Egypt an agreement was entered into with Egyptian Salt and Soda Co. for a joint venture in the synthetic detergent field.

Powell Duffryn

Powell Duffryn Ltd. have acquired the whole of the share capital of Kelmac Ltd. The company owns a limestone quarry at Nether Kellet and produces a wide range of limestone products, including dry and wet mixed graded limestone for road works, bituminous and tarred macadam, concrete aggregate, and material for the manufacture of chemical fertiliser. Mr. Robert Hopwood is chairman of the company and will continue to be responsible for management.

Royal Dutch-Shell

Group sales and operating income of the Royal Dutch-Shell group increased by £227 million in 1959, to £2,578.9 million, and a 2% distribution on Ordinary shares is proposed from share premium reserve.

Gross production of crude, including quantities received under special contracts, averaged 2,465,000 barrels daily, 11% higher than 1958.

Du Pont of Canada

Increases totalling 11% in sales and 37% in net earnings are shown in the report of Du Pont of Canada Ltd. for 1959. Sales for the period amount to $90,920,572 ($81,679,771). Net earnings amounted to $7,168,571 ($5,235,543). After allowance for preferred dividends, earnings were equal to 97 cents a share on Common against 70 cents in 1958.

During 1959 almost $12 million was added to operating investment in lands and working capital which now stands at $125 million. Over the last five years $51,466,000 has been spent on new and enlarged plants, laboratories and similar facilities. The return on average operating investment increased to 6% in 1959 from the 4.9% earned the year before but it had not yet approached the return realised prior to the recent expansion.

Dominion Tar

Consolidated net profit for 1959 of Dominion Tar and Chemical Co., Canada, and subsidiaries was $11,230,918, a record figure ($7,304,497). Consolidated sales were $219,293,198 ($181,376,516). Building materials accounted for 35% of total sales, chemicals 24% and pulp and paper 41%, as compared with 27%, 23% and 50% in 1958. Operating earnings amounted to $34,965,001, or 15.9% of sales ($27,759,821, or 15.3% of sales).

Hercules Powder Co.

Turnover of the Hercules Powder Co., of Wilmington, Delaware, will in the current year be higher by between 10 and 15% than that for last year. Indicative is turnover realised in the first quarter of this year, which is given as $71.3 million, compared with $64.2 million for the same period of 1959.

Stickstoffwerke

The Austrian nitrogen producers Stickstoffwerke, of Linz, announce a turnover for 1959 of 1,200 million Schilling, or some £15 million. Production totalled some 990,000 tonnes of nitrogenous products. Both these results were similar to those for the previous year. Although home sales rose by some 11%, the share of exports in total production fell to 70% due to heavy foreign competition. Some 30 million Schillings, or £375,000, is now spent annually on research by the company.

South African Carbide

Sale of the carbide manufacturing assets of South African Carbide and By-Products Co. has been approved by the shareholders. Purchasers are Holland Electro Chemical Industries (Pty.) Ltd., who have paid £186,061.

Merck and Co. Inc.

The U.S. pharmaceutical concern Merck and Co. Inc. report a record turnover of $217 million (207 million) for the 1959 financial year combined with a re-

cord profit of $30 million (27 million) or 2.79 (2.64) dollars a share. Results for the current year are expected to be satisfactory although the company's board awaits increasing pressure on pharmaceutical prices and profits. The 1959 research investment, a record figure ($18 million) is to be increased in 1960.

Péchiney

The French chemical and metallurgical concern Péchiney realised for last year a net profit of N.F. 38,030,000. This is half as high again as the 1958 total. Over the same period depreciation of the company also rose by about 50%, from 52,900,000 francs in 1958. A dividend is suggested for 1959 of F.4.75 (4.50) on the old shares worth F.50 and of F.3.39 on the new shares resulting from the 1959 capital increase.

INCREASES OF CAPITAL

E. EARNSHAW AND CO. LTD., chemical manufacturers, etc., Plimsoll Street, Basford, Nottingham. Increased by £5,000 beyond the registered capital of £5,000.

G. H. BOWEN LTD., chemical and general engineers, etc., 202 Rolleston Road, Burton-on-Trent. Increased by £40,000 beyond the registered capital of £10,000.

NEW COMPANIES

PROCESS PLANT CONSTRUCTORS (CAMPBELL) LTD. Cap. £3,000. To manufacturer, consult, design and contract to the chemical, petroleum, plastic, rubber textile and other allied process industries and also allied engineering process industries, etc. Directors: C. Campbell, E. Jones, C. E. Speight and J. S. Settle. Secretary: E. Jones. Reg. office: 17 Brazenose Street, Manchester 2.

PHOSTROGEN LTD. Cap. £5,000. Manufacturers and dealers in chemical, organic and soluble fertilisers, etc. Directors: Sir William and Lady Russon and R. W. Manners. Reg. office: St. Anne's Buildings, Barmouth, N. Wales.

WILLIAMS ALCOHOL AND MOLASSES CO. LTD. Cap. £100,000. To manufacture, import, export and deal in alcohol, molasses and chemicals of all kinds, etc. Directors: S. L. Williams, Switzerland; and E. R. Martin, Kent. Reg. office: 32 Bishopsgate, London E.C.2.

People in the News

(*Continued from page* 617)

strand Ltd. in succession to **Mr. A. L. Davies,** who is returning to the U.S. to take up a post of administrative director of the Chemstrand Corporation. Mr. Weston-Webb, who takes up his new duties in August, joined the company in 1959 as deputy managing director in charge of marketing. Other executive changes in the Chemstrand Group include appointment of **Mr. H. Hadden, Jr.,** as vice-president and general manager, Foreign Operations Division; and **Mr. R. G. Hemminghaus** as vice-president, new production planning.

● **Mr. Henry F. Spencer** has resigned as chairman of R.F.D. Co. Ltd. owing to pressure of business, but will remain on the board. He will be succeed by **Mr. A. Noble,** at present vice-chairman.

TRADE NOTES

Cationics as Flocculants

A market development memo, No. 10, is available from Armour Hess Chemicals Ltd., 4 Chiswell Street, Finsbury Square, London E.C.1, dealing with the use of cationic chemicals as flocculants, especially in the flocculation and settling of colloidal silica, where other conventional flocculants have failed.

Neutralising Flue Gases

Control of acidic smut emmission from oil-fired and coal-fired boilers by the D.C.P. system is described in a leaflet issued by Dust Control Processes Ltd., 161 Clarence Street, Kingston-Upon-Thames.

Industrial Furnaces

Head Wrightson Processes Ltd. a subsidiary of Head Wrightson and Co. Ltd., have formed an Industrial Furnace Division at their London offices, 20-24 Old Street, E.C.1. This development will strengthen the services at present offered to the chemical and other industries both in this country and abroad.

Procion Navy Blue Dye

A description of the properties and uses of a new I.C.I. homogenous Procion dye, blue 3RS, is given in a leaflet available from Imperial Chemical House, Millbank, London S.W.1.

Pye Scientific Instruments

Measuring microscopes and cathetometers, automatic sulphur-content determination apparatus, process analysers based on argon chromatography; are among equipment described in the new scientific instruments catalogue from W. G. Pye and Co. Ltd., Granta Works, Cambridge. New developments are also mentioned in pH extension meters, industrial flow type electrode assemblies, and density measuring equipment, etc.

Molybdenum Lubricants

A booklet describing Rocol Ltd.'s range of lubricants based on molybdenum disulphide is available from the company at Rocol House, Swillington, Leeds.

Industrial Finishes

Stoving primers, one-coat acrylic stoving finishes, and air-drying acrylic copolymer solutions developed specially for manufacture of car finishes, are described in leaflets available from Vinyl Products Ltd., Butter Hill, Carshalton, Surrey.

Baker Perkins Service

Baker Perkins Ltd., Westwood Works, Peterborough, have for distribution a leaflet on the subject of their round-the-clock service for the foundry, chemical and plastics industries. There are 10 service depots throughout the U.K.

Shell Micro-Wax

Shell have brought into continuous production at their Stanlow Refinery a 140/145°F micro-crystalline wax which hitherto has only been available from the U.S.A. This new wax has good sealing properties and flexibility and is finding a ready market in the packaging industries for laminating work and in frozen food packs. It is being marketed in the United Kingdom and Eire by Shell Chemical Co. Ltd.

Telephone Number Change

The telephone number of the Incandescent Heat Co. Ltd., London office, has been changed to Belgravia 7803-5.

High-Pressure Hose

High-pressure nylon flexible hose recently added to the existing range of Tecalemit Ltd., Plymouth, Devon, is reported to be "ideal for a wide range of hydraulic and pneumatic applications" especially where rubber hose has not proved satisfactory. It is supplied in bore sizes $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ and $\frac{1}{1}$ in., with burst pressures from 11,000 to 7,000 p.s.i. High flexing properties are also claimed.

Acetic Acid Storage

A booklet is available from the Distillers Co. Ltd., Chemical Division, Devonshire House, Mayfair Place, London W.1, dealing with the storage and handling of bulk supplies of acetic acid.

Oil Retaining Bearings

Copies of a colour brochure describing the company's oil retaining bearings, Lubrook and Ferrocite marques, are obtainable from Bound Brook Bearings Ltd., members of the Birfield Industries Ltd., group, Stratford House, Stratford Place, London W.1.

Extruded, Moulded P.T.F.E.

The fluorcarbon t.f.e. (p.t.f.e.) extruded and moulded shapes made by Polypenco Ltd., 68-70 Tewin Road, Welwyn Garden City, Herts, are described and illustrated in a new brochure available from the company.

Electromagnetic Indicator

Salford Electrical Instruments Ltd., Peel Works, Silk Street, Salford 3, Lancs, have produced a booklet explaining and describing applications of their electromagnetic transducers in the field of instrumentation control. The system provides remote indication of small mechanical displacements by instruments calibrated directly in units of the quantity to be measured.

Automatic Controllers

A publication, No. R.30/2E 1959, is obtainable from Negretti and Zambra Ltd., 122 Regent Street, London W.1 describing the company's automatic controllers and alarm mechanisms.

Change of Address

Offices of Perkin-Elmer (Sales) Ltd. will in future be located with the factory at Beaconsfield, Bucks.

Soldering Fluids

A new technical information sheet describing a group of five special-purpose soldering fluids is available from Perdeck Solder Products Ltd., Abbey Mills, Waltham Abbey, Essex.

Market Reports

SUBSTANTIAL NEW DEMAND REPORTED

LONDON Trading conditions in the industrial chemicals markets have shown little change on the week. New demand both for spot and forward delivery has, in the aggregate, been fairly substantial and the movement against contracts is reported to be fully up to schedule.

Prices remain firm virtually throughout the market. The zinc oxides are dearer, the red seal being currently quoted at £105 per ton.

Fertilisers continue in active request, there being a brisk demand for superphosphates and sulphate of ammonia. Business in the coal tar products has been satisfactory with cresylic acid, creosote oil and crude tar in good demand.

MANCHESTER For most descriptions of chemical products on the Manchester market during the past week the undertone has continued steady. Most industrial consumers of the alkalis and other heavy chemicals are taking regular deliveries under contracts and a fair weight of additional business for early delivery is being done. Overseas shipments to the Commonwealth outlets and to Holland and Western Germany are keeping up satisfactorily. The compound fertilisers and top-dressing materials are moving into consumption in good quantities, and a steady trade is passing in most of the tar products.

SCOTLAND With the level of prices remaining more or less unchanged, the past week has been one of continued activity on the Scottish market.

Again a good volume of business transactions has been against contract requirements and in this direction quantities are being well upheld. Chemicals pertaining to the textile and paper trades have featured well this week. Interest too has been shown in weed killers also agricultural chemicals. There has been little change to report in regard to the export market.

Temporary Exemptions from Import Duty

The Treasury have published as Statutory Instruments 1960, No. 542, details relating to the temporary exemption of import duty on chemicals listed in the Schedule under the Import Duties Act, 1958. The order relates to dyestuffs intermediates and certain pharmaceuticals, and extends the current exemption period from 1 April to 30 September.

DIARY DATES

MONDAY 11 APRIL

Inst. Rubber Ind.—Manchester: Engineers' Club, Albert Sq., 6.45 p.m. Manchester Section a.g.m.

S.C.I.—London: 14 Belgrave Sq., S.W.1., 5.30 p.m. Pesticides group a.g.m.: 'Trends in control of infestation of stored products', by Dr. E. E. Turtle.

TUESDAY 12 APRIL

I.Chem.E.—London: Park Lane Hotel, Piccadilly, W.1., 7 p.m. A.g.m., and annual dinner & dance.

Iron & Steel Inst. with Inst. Metals.—London: Church Hse., Gt. Smith St., S.W.1., 10.30 a.m. Papers on 'Direct rolling processes in powder metallurgy'.

S.C.I.—Birmingham: Birmingham & Midland Inst. 5.45 p.m. Section a.g.m. and at 6.30 p.m. 'Recent developments in chemistry of carbohydrates', by Prof. W. G. Overend.

S.C.I.—Liverpool: Donnan Labs., University, 6.30 p.m. Oil & fats group a.g.m., and 'Recent work in phospholipid field', by Dr. T. Malkin.

S.C.I.—London: 14 Belgrave Sq., S.W.1., 6 p.m. 'Recent developments in factory floorings', by S. C. Chigison.

WEDNESDAY 13 APRIL

Plastics Inst.—Cardiff: Angel Hotel, 6.30 p.m. 'P.v.c. coated metals', by F. H. Smith & W. E. Martin.

S.A.C.—London: Burlington Hse., Piccadilly, W.1., 7 p.m. 'Assay of gonadotrophins in body fluids', by J. A. Loraine; 'Insulin assay in plasma by the rat diaphragm method', by P. H. Wright.

S.C.I.—London: 14 Belgrave Sq., S.W.1., 6.15 p.m. Nutrition panel a.g.m., chairman's address by Dr. F. Aylward.

THURSDAY 14 APRIL

S.C.I. with Soc. Instrument Tech.—Liverpool: Industrial Developments Centre, 83 Paradise St., 7 p.m. 'Automatic titrators & related equipment', by D. A. Patient.

FRIDAY 15 APRIL

S.D.C.—Manchester: 10 Blackfriars St., 7 p.m. Manchester Section a.g.m., followed by 'New work on dyeing of nylon with disperse dyes', by H. Seamon.

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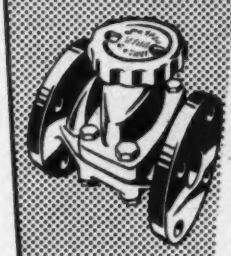

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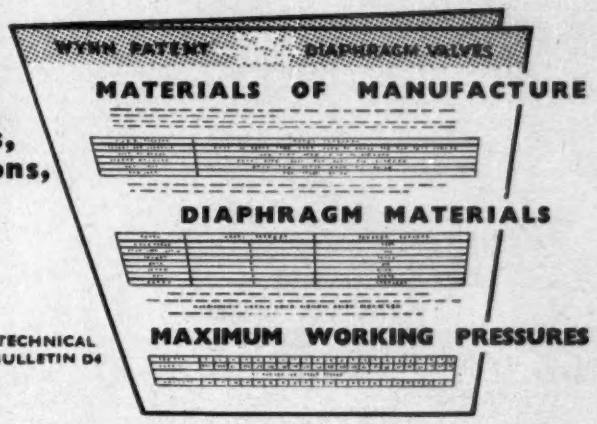

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NEW PATENTS

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Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection 11 May

Electrolytic manufacture of cysteine hydrochloride. Aschaffenburger Zellstoffwerke AG. **834 910**

Production of aromatics and catalysts therefor. British Petroleum Co. Ltd., Holmes, P. D., and Stalley, J. C **834 912**

Dehydrogenation or dehydrocyclization of non-aromatic hydrocarbons. British Petroleum Co. Ltd., Holmes, P. D., and Stalley, J. C., and Moy, J. A. E. **834 581**

Steroids and biologically-active preparations containing steroids. Organon Laboratories Ltd. **834 913**

Oxidation of hydrocarbons to ketones. Imperial Chemical Industries Ltd. **834 590**

Recovery of radioactive caesium. U.K. Atomic Energy Authority. **834 914**

Preparation of perchloryl fluoride. Pennsalt Chemicals Corp. **834 594**

Flameless reaction of gaseous hydrocarbons to form carbon monoxide and hydrogen. Badische Anilin- & Soda-Fabrik AG. **834 595**

Pyridine compounds. Merck & Co. Inc. **834 451**

Method for improving the adhesion of polyester resins on metals, and for the direct combination of metal parts as well as of objects described in this method. Mauser, R., Mauser, A., Mauser, P., and Mauser, E. **834 917**

Derivatives of piperidine and the preparation thereof. Wellcome Foundation Ltd. **834 453**

Oxidation of methylpyridines. Chemon Corp. **834 919**

Anthraquinone vat dyestuffs. Ciba Ltd. **834 456**

Method of desulphurising hydrocarbon oil. Standard Oil Co. **834 460**

Steroid compounds and their preparation. Merck & Co. Inc. **834 926**

Steroid compounds. Merck & Co. Inc. **834 828**

Aromatic sulphonamides. Farbenfabriken Bayer AG. **834 929**

Filling of acetylene cylinders with solid material. Käuflein, M. **834 939**

Production of halohydrins of styrene and styrene substituted in the side chain and/or in the nucleus. Deutsche Gold-und-Silber-Scheideanstalt vorm Roessler. **834 599**

Production of olefin polymers. Phillips Petroleum Co. **834 933**

Manufacture of magnesium aluminosilicate. Fuji Kagaku Kogyo Kabushiki Kaisha. **834 934**

Preparation of polyvinyl chloride. Hercules Powder Co. **834 937**

Production of solid polymer and polymer so produced. Phillips Petroleum Co. **834 477**

Preparation of bis-testosterone and the 17-acetate thereof. Laboratoires Francaise de Chimiotherapie. **834 692**

Polymeric materials. Du Pont de Nemours & Co. E. I. **834 942**

Organosiloxanes. Midland Silicones Ltd. [Addition to 832 487.] **834 711**

Quaternary ammonium compounds. Rohm & Haas Co. [Divided out of 834 410.] **834 411**

Preparing a polymer composition and resulting polymer compositions. Bataafsche Petroleum Maatschappij NV., De. **834 855**

Partially acetalated polyvinyl alcohol fibres. Mitsubishi Rayon Co. Ltd. **834 612**

Dispersing pigments in vinyl chloride resins. Union Carbide Corp. **834 857**

Producing crystalline ammonium bifluoride. Wasag-Chemie AG. **834 614**

Production of thermoplastic methyl methacrylate butadiene polymer interpolymers. Rohm & Haas Co. **834 859**

Production of co-polyamides. Badische Anilin- & Soda-Fabrik AG. **834 860**

Siloxanes. Midland Silicones Ltd. **834 730**

Production of low molecular weight graft co-polymers from vinyl acetate and polyisobutylene and the co-polymer produced thereby. Haris Kabushiki Kaisha. **834 954**

Fire-resistant cellular vinyl aromatic polymer articles. Dow Chemical Co. **834 956**

Manufacture of carbon black. Columbian Carbon Co. **834 634**

Polymerisation process. Esso Research & Engineering Co. [Divided out of 834 894.] **834 895**

Apparatus for treatment of liquids through a membrane. Kemp, J. A. (Thomas, A.). **834 645**

Preparation of L-glutamine. Rath, S. **834 650**

Condensation of an aromatic amine with a halonitrobenzene to provide a nitrophenyl amine. Goodyear Tire & Rubber Co. **834 510**

Cyclo-octanone oxime hydrochlorides which are liquid at room temperature, and a process for their production. Badische Anilin- & Soda-Fabrik AG. **834 513**

Potassium monopersulphate. Du Pont de Nemours & Co. E. I. **834 514 & 834 515**

Anthraquinones dyestuffs for synthetic fibres. Farbenfabriken Bayer AG. [Addition to 787 379.] **834 518**

Dyestuffs of the anthraquinone series. Ciba Ltd. **834 949**

Production of alkali metal cyanides. Du Pont de Nemours & Co. E. I. **834 765**

Process of preparing a fertiliser. Stamicarbon NV. **834 766**

Production of glycerol and glycols. Inventa AG. **834 771**

Purification of irradiated 7-dehydrocholesterol. Nopco Chemical Co. **834 773**

Salts of S-(1, 3, 5, 7-tetramethyl octyl) mercapto acetic acid and compositions stabilised therewith. Uclaf. **834 774**

Production of mixed catalysts for low pressure polymerisation of olefins. Chemische Werke Hüls AG. **834 777**

Destroying emulsion stabilisers. Separator AB. **834 778**

Preparation of fibres and related shaped articles of polymers and copolymers of acrylonitrile. Dow Chemical Co. [Divided out of 834 523.] **834 524**

Chlorobenzoic amides and herbicidal compositions containing them. Hooker Chemical Corp. [Divided out of 833 218.] **834 880**

Open to public inspection 18 May

Concentration of plutonium. Werner, L. B., Fries, B. A., and Seaborg, G. T. **835 212**

Ion-exchange processes. Permutit Co. Ltd. [Additions to 714 642.] **835 206 & 835 207**

Centrifugal pumps for liquids containing abrasive materials. Grant, V. D., and Prince, C. A. **835 233**

Compounds of alginic acid. Alginate Industries Ltd. **835 009**

Apparatus and method for producing gas-generating charges. Imperial Chemical Industries Ltd. **835 110**

Stabilised liquid dielectric materials. General Electric Co. **835 255**

Method of preparing alkyl and unsymmetrical dialkyl hydrazines. Aerojet-General Corporation. **835 416**

Process for burning the sulphite lye and wash from sulphite alcohol production plants. Prvni Brnenska Strojirna, Zavody Klementa Gottwalda. **835 248**

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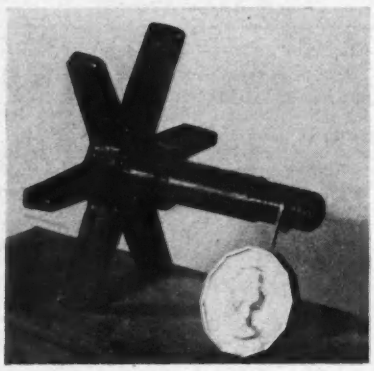

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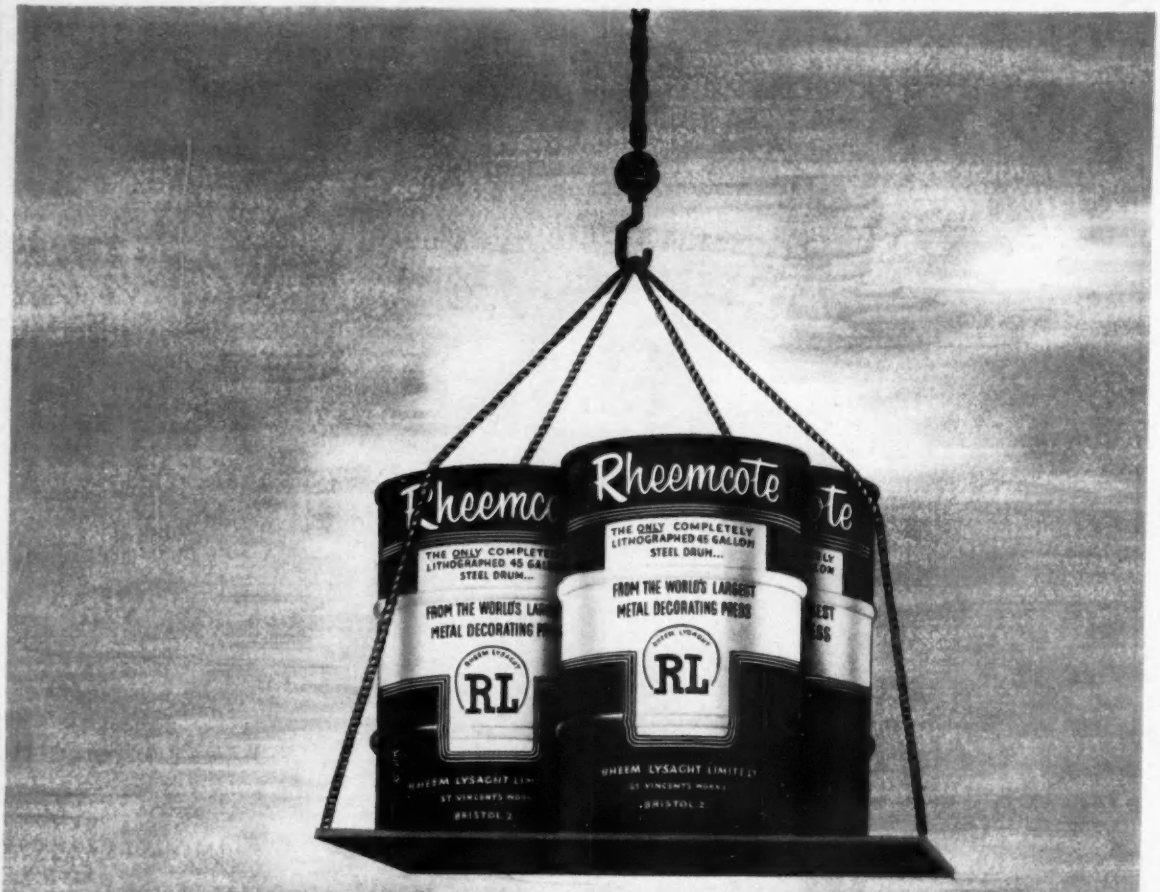

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